MODERN PLASTICS

mp

MARCH 1942

R v. 19² Mar.-Aug. 1942

Tech.

REED PRENTICE MACHINES

for Outstanding Performance on Small or Large Moldings

MOLDINGS ILLUSTRATED
Produced by
OHIO PLASTICS CO.
Frazeysburg, Ohio

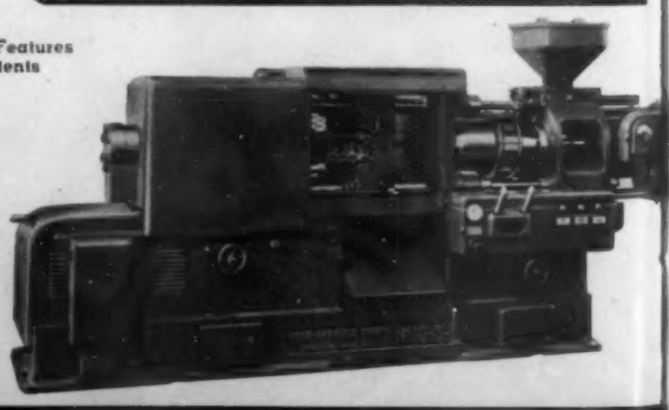
CONDENSED SPECIFICATIONS			
Models	10A-4	10D-6	10D-8
Capacity	4 oz.	6 oz.	8 oz.
Injection pressure (Lbs. per sq. in.)	20,000	20,000	20,000
Mold closing press. (Tons)	225	325	325
Mold opens	10¼"	10¼"	10¼"
Weight without elec. equip. (Lbs.)	10,000	11,500	12,000

The versatility of Reed-Prentice injection molding machines is exemplified by these representative examples. All produced on our 6 oz. machine, they range from work of small intricate nature to heavy section molding exceeding the rated capacity of the machine.

The Jackstones are molded at 2⅛ cycles per minute, complete shot weighing 2½ oz; 40 cavity mold. Extraordinary production, 50 pieces per hour, is obtained in the Bookend which weighs, including sprue and runner, 8 oz. Again the Machete Handle is produced in a 4 cavity mold at one cycle per minute. Total weight including sprue and runners 7 oz.

Whatever your injection molding problem you will find in Reed-Prentice machines those characteristics that set new standards of dependability and product superiority at low operating cost.

Reed-Prentice Features covered by Patents Pending



REED-PRENTICE CORPORATION

WORCESTER, MASS. ★ 75 West St., New York City ★ 1213 W. 3rd St., Cleveland, Ohio

OVER 487 MACHINES IN SUCCESSFUL OPERATION

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modern plastics

MARCH 1942

VOLUME 19 NUMBER 7

• GENERAL INTEREST

• TECHNICAL SECTION

• NEWS AND FEATURES

APRIL

Efficiency in record keeping today involves more than just filing information. Vital facts for industrial and military purposes must be obtainable at short notice. The Visible Index Corp. has developed equipment for a system of vertical record keeping which makes use of extruded plastic strips, shown on the dividers in the filing tray above, and other plastics. The complete story will appear in April.

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Sight-feeds of tough, crystal-clear "Lucite" prove oil goes to vital parts of industrial equipment!

"**SEEING IS BELIEVING**" with the new McCord "SF" Lubricators. You know they're feeding oil to vital bearings because you can see it delivered—even when you're at quite a distance or angle. To assure this great visibility and transparency, these sight-feeds are made of crystal-clear "Lucite" methyl methacrylate resin. But that's only half the story. They're tough, too!

The feeds have to withstand internal pressures when used on industrial engines and compressors. "Lucite" easily does this because of its great strength. And the Du Pont "Lucite" resists the external blows and hard usage common to factory conditions.

You don't make sight-feeds? All right. But consider what all this can mean for *your* future product's transparency and strength . . . as well as toughness . . . good looks . . . resistance to oils, chemicals and weathering. Also ease of production—"Lucite" is readily molded or fabricated, even into intricate shapes. And lightweight—"Lucite" almost floats in water!

"Lucite" and other Du Pont plastics go today into important industrial and military equipment. But if you have any questions on design of new plastics parts or problems on your present ones, let's hear from you. Our Technical Service men will be glad to assist.

E. I. du Pont de Nemours & Co. (Inc.), Plastics Department, Arlington, N. J.

"LUCITE" IS REG. U. S. PAT. OFF.

DU PONT
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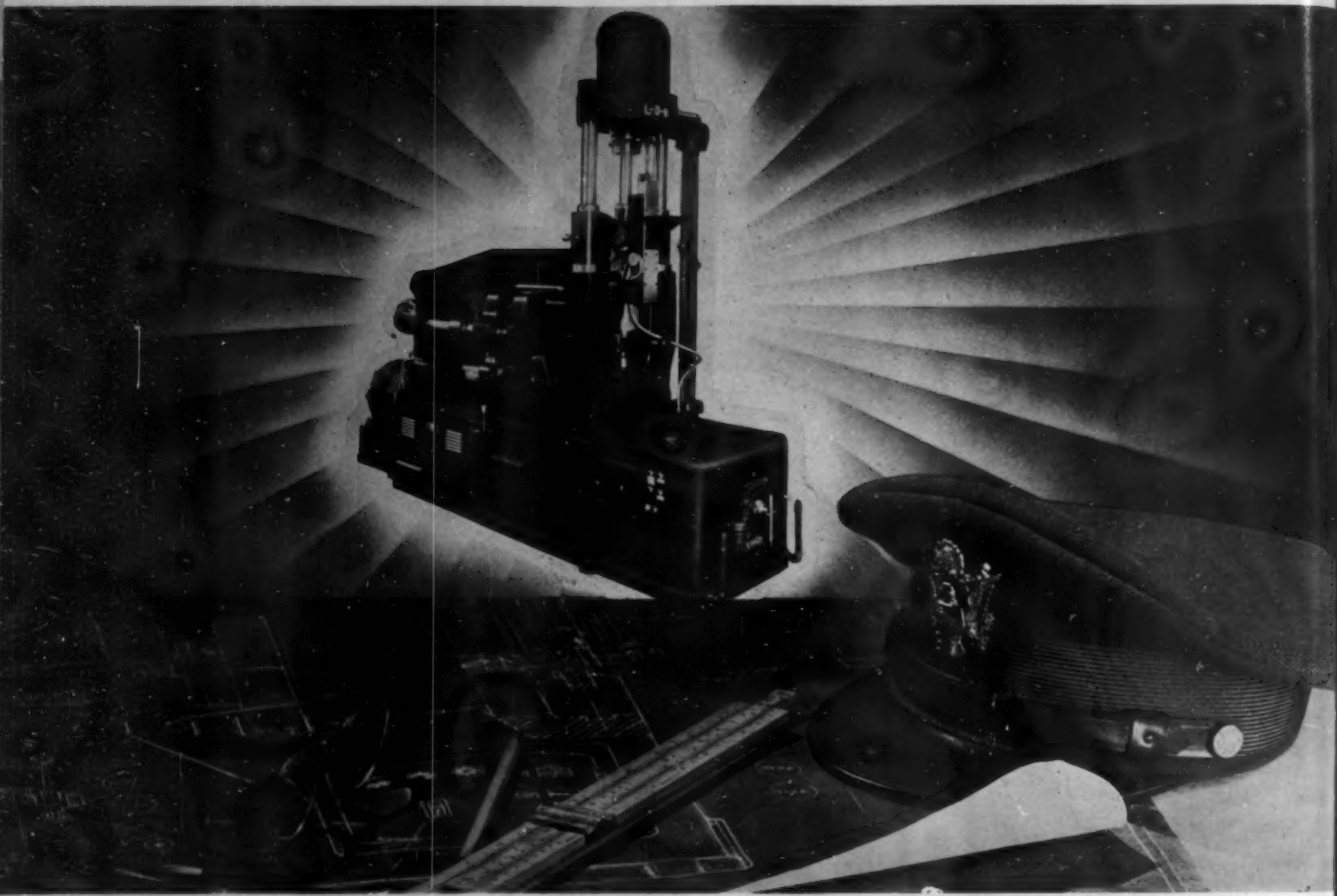
PLASTICS

Listen to stars of stage, screen and radio on "Cavalcade of America" every Monday eve. over coast-to-coast NBC Red Network




TO CONTRACTORS AND SUB-CONTRACTORS WORKING ON WAR ORDERS
On contracts where plastics are required (for insulation, transparency, toughness, lightness with strength, etc.) or where plastics can step up the production rate (by injection, compression, or transfer molding; extrusion; lamination; etc.) specialized experience can save valuable time in setting up plastics production schedules, and in mastering new techniques of applying plastics.
In the interest of "speed and speed now," we offer to pool the knowledge of our engineers with your experience wherever it will help. Because our company is the oldest in the industry, we can provide experience records and data not generally available. It is our desire to share this knowledge with any company in the "Victory business."
Replies to this message, in regard to advice or materials, should be addressed to *War Materials Division* for quick identification and attention.
Celanese Celluloid
CORPORATION
LUMARITH and LUMARITH PROTECTOID

STOCK DIALS AND KNOBS
No. S-54-3; bushing and set screw; dia. 1⅛"; ht. 9/16"; depth hole 7/16".
No. S-17-3L; filled arrow; bushing and set screw; dia. 1⅛"; ht. 9/16"; depth hole 7/16".
OFF ON
(Right) No. S-311-3: ¼" bushing. No. S-311-1 no bushing; with set screw; dia. skirt 2 1/16"; ht. 29/32"; depth hole 41/64".
(Above) No. S-6537-3L; filled arrow; bushing and set screw; dia. 1½"; ht. ¾"; depth hole ⅜".
No. S-246-3L; heavy duty bar knob; bushing and set screw; filled pointer; rad. 3/4" ht. 7/8"; depth hole 23/32".
No. S-293-1L; set screw; no bush.; filled pointer; radius 1⅛"; ht. ⅜"; depth hole ½".
No. S-6844-1; set screw; no bushing. No. S-6844-3; bushing and set screw. No. S-6844-29; push-on type with spring; ht. 5/8"; depth hole 17/32". No. S-6844-3-517; bushing and set screw; metal pointer; radius 11/16".
No. S-81-3; 1/4" bushing and set screw; dia. 1⅝"; ht. 11/16"; depth hole 15/32".
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COMMUNICATIONS EQUIPMENT
Scores of sizes and designs ... many stocked in Dayton ... others quickly available in black and walnut bakelite, or in special colors. All models shown on this page (actual size) are ready for immediate shipment. Write, wire or phone for prices, or information on stock styles which may fit your special needs.
Pointers available on all instrument knobs.
KURZ-KASCH
Kurz-Kasch, Inc., 1417 South Broadway, Dayton, Ohio • Branch Sales Offices: New York, Chicago, Detroit, Los Angeles, Dallas, St. Louis, Toronto, Canada • Export Office: 89 Broad Street, New York City.
No. S-310-3; ¼" bushing. No. 310-1: no bushing. With set screw; dia. 2⅜"; ht. 7/8"; depth hole 41/64".
No. S-292-1L; set screw; no bushing; filled pointer; radius ⅜"; ht. ⅜"; depth hole ½".

POLISHING PLEXIGLAS

• *Using a soft, dry cloth, this worker is bringing waxed* PLEXIGLAS *to a high gloss. Army and Navy bombers, PT boats, and other military materiel depend for their efficiency upon permanently transparent* PLEXIGLAS *sections.*

Approved polishing procedures are outlined step by step in this diagram, typical of many in the new PLEXIGLAS *Fabricating Manual. A copy of this important new work will be gladly sent on request.*

THERE are wrong ways and right ways to polish PLEXIGLAS to bring this crystal-clear plastic to its highest transparency. Knowing all the right ways can help you speed production and reduce rejects in the manufacture of the PLEXIGLAS units needed for defense.

A new PLEXIGLAS Fabricating Manual just issued describes in detail the best methods not only for polishing PLEXIGLAS but for other fabrication operations.

WRITE TODAY FOR A COPY OF THIS NEW MANUAL

PLEXIGLAS and CRYSTALITE are the trade-marks, Reg. U. S. Pat. Off., for the acrylic resin thermoplastics manufactured by the Rohm & Haas Company.

THE CRYSTAL-CLEAR ACRYLIC PLASTICS

PLEXIGLAS

SHEETS AND RODS

CRYSTALITE

MOLDING POWDER

ROHM & HAAS COMPANY

WASHINGTON SQUARE, PHILADELPHIA, PA.

Manufacturers of Leather and Textile Specialties and Finishes . . Enzymes . . Crystal-Clear Acrylic Plastics . . Synthetic Insecticides . . Fungicides . . and other Industrial Chemicals

Why this *"Flying High School"* has Fibestos Windows

To SAVE thousands of vital hours of advanced training the Army Air Corps is acquiring hundreds of these trim, twin-engined transition trainers just as fast as the Curtiss-Wright Corporation can roll them off the assembly lines.

To save equally vital hours, both in production and maintenance of the finished ships, windows and skylights are being fabricated of tough, resilient Fibestos, Monsanto's transparent cellulose acetate sheets.

Training time is cut by the fidelity with which these AT-9's duplicate the flight and control characteristics of actual fighting craft, thus bridging the wide gap for student airmen between single-engined, primary trainers and speedy pursuits or multi-engined bombers.

Production time is saved by the ease with which Fibestos can be fabricated and installed. Maintenance is facilitated because Fibestos is tough and rigid enough to give many long hours of trouble-free service, yet resilient enough to speed installation of replacements. Equally important, production and maintenance savings are made at no sacrifice in transparency, thanks to the excellent clarity and light transmission of Fibestos. MONSANTO CHEMICAL COMPANY, Plastics Division, Springfield, Massachusetts.

MONSANTO PLASTICS
SERVING INDUSTRY...WHICH SERVES MANKIND

"E" for Excellence . . . the pennant denoting the highest service accomplishments in the United States Navy . . . flies with the Naval Ordnance flag over Monsanto. In the words of the Secretary of the Navy, this award has been made to Monsanto "in recognition of your outstanding efforts in the production of ordnance materiel vital to our national defense."

THE FAMILY OF SIX MONSANTO PLASTICS

(Trade names designate Monsanto's exclusive formulations of these basic plastic materials)

LUSTRON (polystyrene) · OPALON (cast phenolic resin)
FIBESTOS (cellulose acetate) · NITRON (cellulose nitrate)
SAFLEX (vinyl acetal) · RESINOX (phenolic compounds)

Sheets · Rods · Tubes · Molding Compounds · Castings
Vuepak Rigid Transparent Packaging Materials

Are Serving in

THE BATTLE OF PRODUCTION

● In our country's all-out war effort, selective service applies to materials as well as to men. REILLY INDUR PLASTICS are included in those materials reserved for war service. Because of their light weight, easy molding qualities, superior structural strength and high electrical resistance, and the fact that they are unaffected by moisture, oils and most acids, these phenolic plastics are replacing metals in the manufacture of scores of instruments and devices which are directly and indirectly essential to our defensive and offensive program.

REILLY INDUR PLASTICS are available, therefore, only on priority ratings. We will be glad to work with you to supply needed defense materials, and will do our best to serve you.

REILLY TAR & CHEMICAL CORPORATION

Executive Offices: Merchants Bank Building, Indianapolis, Indiana

2513 S. Damen Ave., Chicago, Illinois • 500 Fifth Ave., New York, N.Y. • St. Louis Park, Minneapolis, Minn.

Reilly COAL-TAR PRODUCTS

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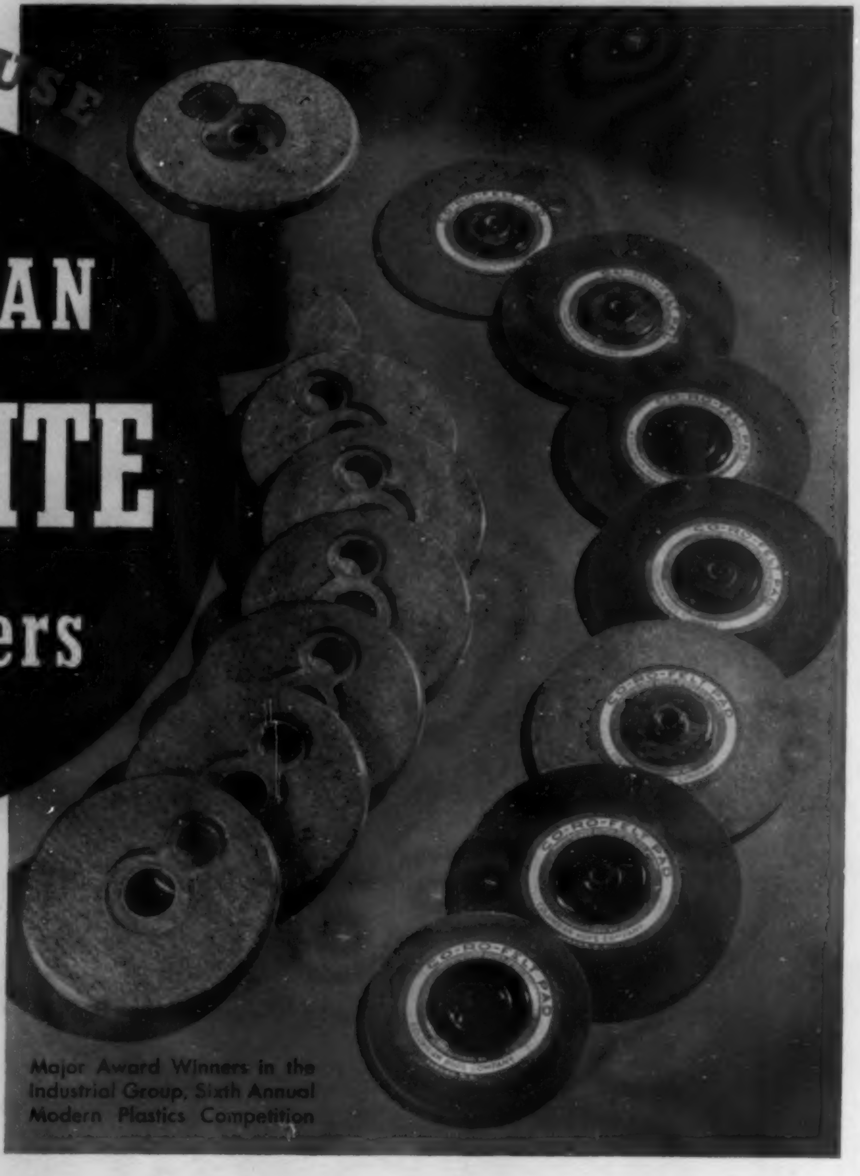
GENERATOR
SAFE
DANGER
SEARS
SEARS

Now—The Economy and High Impact Strength of Laminates, plus MOLDABILITY

WHEN YOU USE

COLUMBIAN
CO-RO-LITE
Sisal Fillers



Major Award Winners in the Industrial Group, Sixth Annual Modern Plastics Competition

NOW—get thermosetting plastics of HIGH IMPACT STRENGTH . . . in a wider range of molding shapes . . . a wider range of specific gravities . . . and a wider range of densities. By using Columbian CO-RO-LITE you can obtain weights and densities equivalent to wood . . . and you can actually blend rigidity with elasticity.

The Co-Ro-Lite process combines tough sisal cordage fibers into a fluffy batting and then consolidates the material by a needling operation which drives tufts of fiber through the mass. This Co-Ro-Lite filler has a volumetric composition of one part fiber to six parts void space, providing extreme lightness with a firmness sufficient to withstand the handling in applying the resins. Flash molds may be used. Penetration of resinous solutions is rapid, and receptivity to powdered substances, is high.

Sheets and molded shapes are produced, suitable for cams, gears, bobbin heads, bearings, tension and compression members, abrasive disk hubs and backs, as well as other industrial applications.

● **WRITE or WIRE for physical data and production recommendations.**

ALLIED PRODUCTS DIVISION

Patent No. 2,249,888
Other Patents Pending

COLUMBIAN ROPE COMPANY
400-10 Genesee St., Auburn, "The Cordage City" N. Y.


FASTER and FASTER
ASSEMBLY
with
Speed Nuts
Where aircraft attachments have been changed over to Speed Nuts and Speed Clips, savings of 50% in cost and reduction of 70% in weight were almost universal.
This is not loose sales talk but an actual fact known by Defense Equipment Assembly Engineers, who have had years of experience with the SPEED NUT SYSTEM in the assembly of civilian products.
Besides these amazing gains in speed and reductions in weight and costs, the SPEED NUT SYSTEM also provides a Double Spring-Tension Lock that solves the problem of vibration loosening.
Let the speed of the SPEED NUT SYSTEM Keep 'em Flying and Keep 'em Rolling, FASTER and FASTER. First step is to send your assembly details so we can rush samples and engineering data promptly.
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MANUFACTURERS OF PATENTED SPEED NUTS
2048 FULTON ROAD, CLEVELAND, OHIO
IN CANADA: Wallace Barnes Co., Ltd., Hamilton, Ontario
IN ENGLAND: Simmonds Aerocessories, Ltd., London
LET'S GO! U.S.A. KEEP 'EM FLYING!
THE FASTEST THING IN FASTENINGS!
OVER A BILLION IN USE ★ ★ OVER 1,000 SHAPES AND SIZES

Makalot

... emphasizes PRACTICAL Research in its Phenolic and Urea Plastics

"Too Much - Too Soon" is no new objective for the Plastics Industry.

Just as the keynote of 1941 was the all-out effort for Defense, just so does increased production assume greater importance for 1942.

MAKALOT'S production staff accepts the challenge for a larger output of its justly famous Standard Numbers. Meanwhile, Makalot research engineers have teamed up with Makalot production experts to develop practical modified "emergency" formulas, whereby the satisfactory extension of present established materials is made possible.

Thus, through Makalot's practical experience and resourcefulness .. many molders are enabled to fill certain contracts, which otherwise could not be filled ... were it not for Makalot's PRACTICAL teaming up of Production with Research.

One thing is as sure as night follows day .... Makalot STANDARD Numbers will ever remain standard. The 100th drum of a given Makalot Number is sure to mold identically with the 1st or 50th drum. Yes, Makalot's recently doubled plant and research facilities are paying dividends for our customers, day in and day out, by improving the characteristics of present plastic materials ..... and in developing new properties and new materials of far reaching Defense and Commercial importance.

Y O U SHOULD INVESTIGATE AT ONCE the following ...

1040	LOW-LOSS - the best molding low-loss Phenolic yet developed.	
2962	BROWN	neither will crack .. around large or small inserts.
1962	BLACK	
1808	SEMI-IMPACT	
66 E	IMPACT	
93 C	SUPER-STRENGTH IMPACT	

We can help Y O U with y o u r problems.

(1) By doing "the job that couldn't be done" ....
(2) by giving that extra measure of Service ....
(3) and by standing squarely on its merits as "A BETTER PRODUCT" --

an ever increasing clientele of customers assure us that

"MAKALOT WILL NOT BE FORGOTTEN" ... because Makalot does not forget its Customers.

M. M. Makeever

President

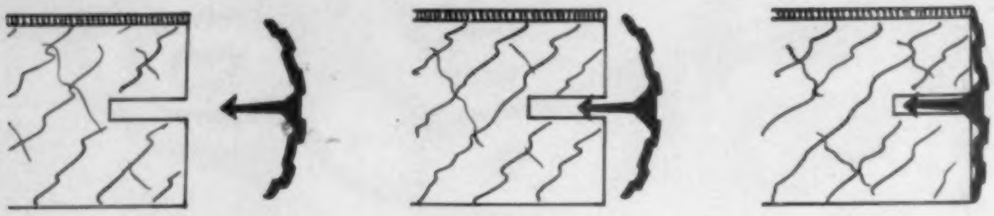
The Independent Producer of Superior Plastics

MAKALOT CORP.
Boston, Mass.
March - 1942

for Central States - C. R. Olson, Rockford, Ill.

Extruded plastic shapes and tubing of cellulose acetate butyrate (Tenite II) are now available as an alternate for essential materials where suitable. The shapes and tubing listed below are stocked for immediate delivery. Special shapes and tubing will be made to order.

INTERLOX†



*13 functional Interlox† shapes for the following uses: table and counter edgings, divisions for heavy wallboard and insulating board, and framing for glass and plywood.

*20 functional shapes for use with wallboards of various thicknesses. These shapes hold the boards in place and cover the seams.

*24 functional shapes for use with linoleum and related materials for kitchens. Edgings for sink wells, nosings for cabinet counter edgings, and caps and covers for sink splash-boards are representative of the shapes and their uses.

All of these shapes are easily fabricated and installed, thereby adapting them for use in the construction of defense housing.

Extruded plastic tubing is now available in a range of sizes from 3/16" O.D. to 3/4" O.D. in long length coils and straight lengths. It is seamless and stocked in transparent material only. A wide range of colors is available on special order. The tubing may be readily bent, formed, or coiled, adapting it for use in the fabrication of many industrial products.

* National sales distribution through Julius Blum & Co., Inc., New York City. Warehouse stocks of these shapes and tubing are strategically located throughout the United States and Canada.

† U. S. & Canadian Patents Applied For.

Industrial Shapes to special order:
Maximum width 3"
Maximum weight 6 oz. per ft. (sp. gr. 1.2)
Straight lengths up to 12' to fine tolerance
Note: We are not prepared to quote on special shapes unless such shapes are needed for defense purposes.

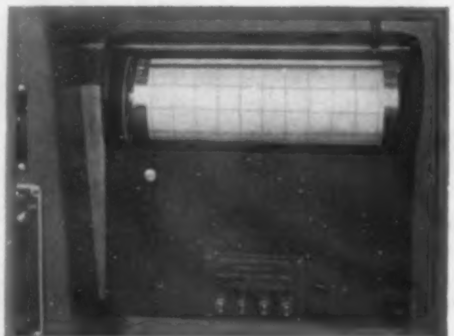
EXTRUDED PLASTICS
INCORPORATED
NEW CANAAN AVENUE
NORWALK, CONN.

INTERLOX
PLASTIC TRIM

NORWALK 6-1585

FASTER TESTING

Instantaneous Records



SOUTHWARK TEMPLIN HIGH MAGNIFICATION RECORDERS offer you these outstanding advantages:

ACCURACY is of the same high order as the Southwark-Tate-Emery testing machine itself.

SENSITIVITY is as fine as that of the Tate-Emery indicator.

FAST—15 tests an hour—one every four minutes—is typical in routine testing work.

SOUTHWARK RECORDERS ARE AVAILABLE FOR ALL STANDARD MAKES OF PHYSICAL TESTING MACHINES.

IT'S EASY to run fast, accurate tests and have a permanent record of each, on a recorder-equipped Southwark-Tate-Emery testing machine. A continuous-line stress-strain curve is plotted simultaneously with each test—eliminating laborious manual plotting. The null-method indicator provides ample power to operate the recorder without stealing any of the load balancing force to overcome the friction developed by this function.

Easy operating grip holders, and spot-control crosshead adjustment permit rapid set-up; simple, valve controls and the exclusive instant-change multi-range 66-inch dial give this machine unparalleled ease of operation. Write for Bulletin T-161.

You can speed up your testing with a Southwark-Tate-Emery!

Baldwin Southwark Division, The Baldwin Locomotive Works, Philadelphia; Pacific Coast Representative, The Pelton Water Wheel Co., San Francisco.

Baldwin Southwark

DIVISION OF

THE BALDWIN LOCOMOTIVE WORKS • PHILADELPHIA

BLW THE BALDWIN GROUP


PLASTIC
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MOLDINGS
RIBBONS
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TUBES
COLORFUL
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PYRIDIUM
VI-SYNERAL
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and as Modern as Tomorrow's motifs
EXTRUDED MOLDINGS: An unlimited range of color and shape in Cellulose Acetate, Vinylite, Polystyrene, Ethyl Cellulose, etc., and every facility for prompt co-operation and production.
CELLUPLASTIC CONTAINERS: Limitless color selection; featherlite and shatterproof containers in vial, jar, bottle and tube shapes, opaque or transparent.
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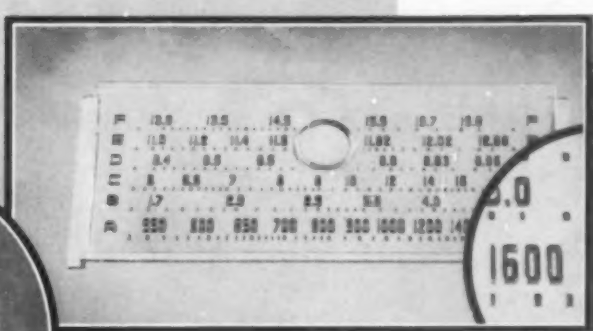
PLASTIC MOLDING THAT *Clicks* ✓✓

✓ WITH THE BUYER
✓ WITH THE USER



ERIE "THREE DIMENSIONAL" PLASTICS*

CRYSTAL-CLEAR molded plastics and colorful paint team together in Erie "Three Dimensional" Plastics to produce unusual beauty and serviceability in plastic articles.

The characters and design lines are indented from the rear surface when the article is injection-molded of clear plastics. Various portions of the rear surface are then painted any desired color. For example, in the Ford horn button, illustrated above, the keystone underneath the lettering is brilliant red, and the remainder of the button is finished in two tones of gold. Striking effects can be obtained by the simple use of black and white, as in the 5¢ marker shown in the upper left.

Because all colors are applied on the rear, the top surface is perfectly smooth, clear plastics. The paint cannot wear off and the articles retain their original lustre and depth of color forever.

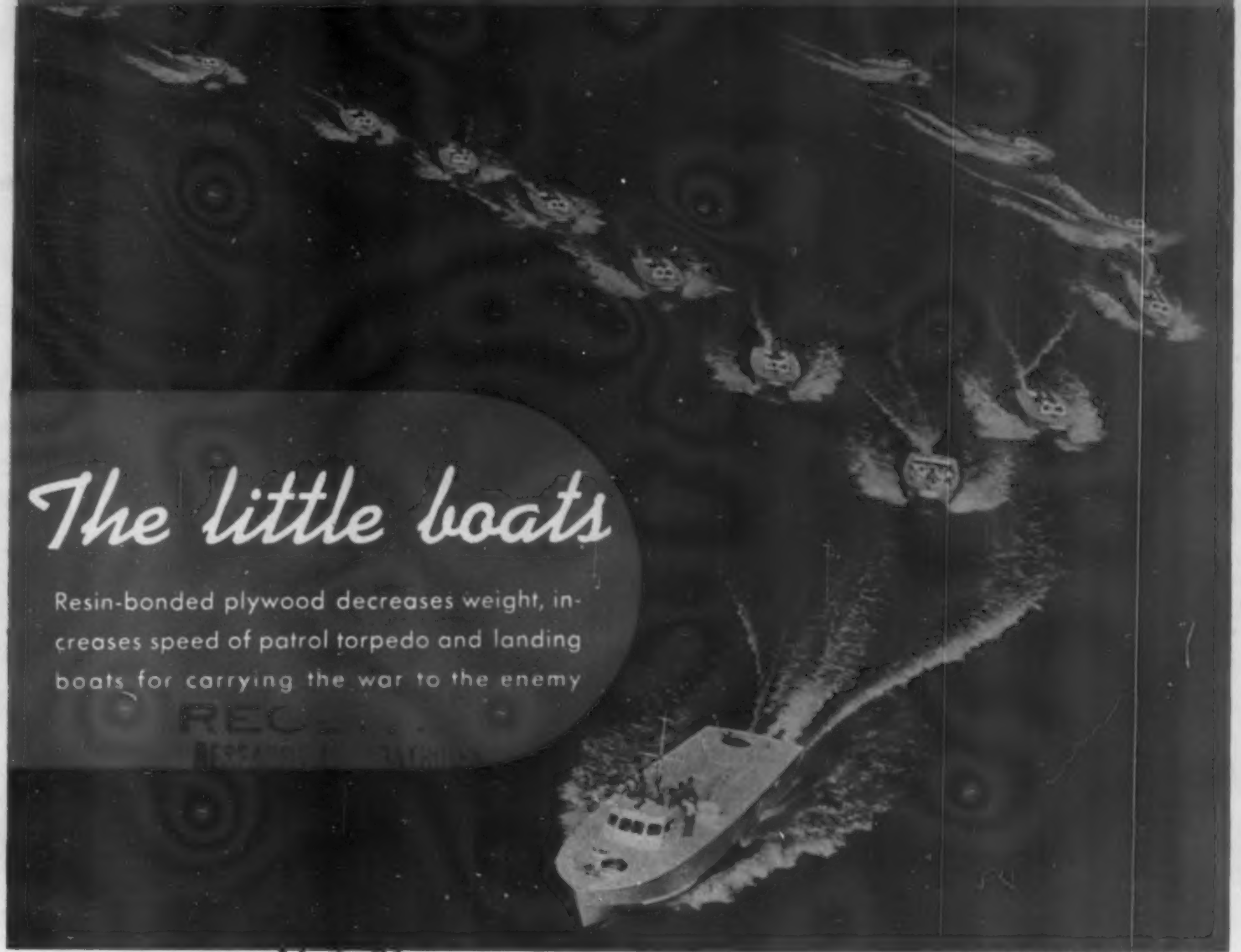
This Erie "Three Dimensional" molding technique is applicable to a wide variety of products for both military and consumer use now being made in plastics or metal. Erie plastic engineers will show you how "Three Dimensional" Plastics can be utilized to enhance the appearance and serviceability of your product.

* Licensed under Cardinal Corporation process.

ER *Plastics Division* ER

ERIE RESISTOR CORPORATION, ERIE, PA.

MODERN PLASTICS
MARCH 1942 VOLUME 19 NUMBER 7



The little boats

Resin-bonded plywood decreases weight, increases speed of patrol torpedo and landing boats for carrying the war to the enemy

PHOTOS, COURTESY HIGGINS INDUSTRIES, INC.

1—Motor patrol torpedo boat leading a flotilla of landing boats in a practice run. Speed and maneuverability characterize these trim little craft

PROUD ships of the line—Britannia, Neptune, Temeraire—*stood off the chalk cliffs in 1805, while across the Channel massed armies of the Gallic conqueror readied for the crossing.* Ajax, Agamemnon, *"those distant storm battered ships, on which the Grand Army never looked, stood between it and the dominion of the world."*

Jaunty little cruisers—Nellie, Firefly, Polly III—*ferried tirelessly in 1940 between the makeshift jetties at Dunkirk and the larger craft offshore.* Lady Jocelyn, Folkstone Belle—*putputting back and forth, carrying 300,000 men to safety while the planes fought in the sky and the jaws of the Nazi pincers closed on an empty beach.*

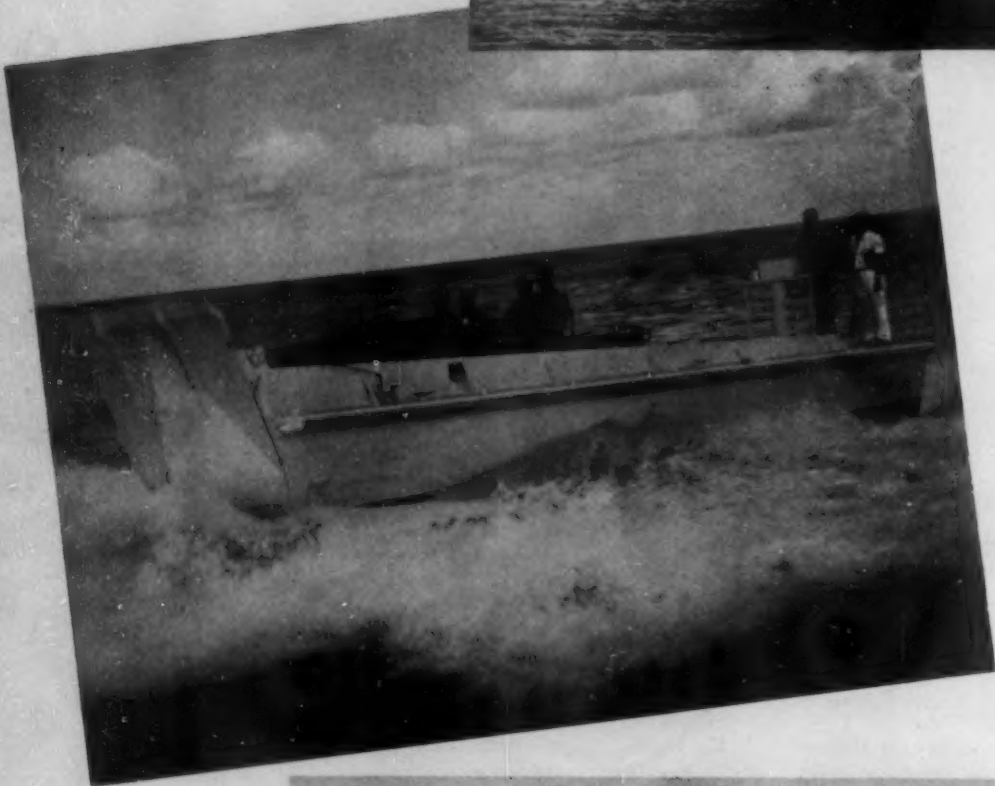
Napoleon and Hitler, with their dreams of world domination, were both helpless against the big ships and the little boats.

In 1942, when a globe-encircling war is fought in terms of every continent, every island, every sea and every air-lane in the world, defensive action is not enough. As Mr. Churchill reminded the British after Dunkirk, "Evacuations do not win wars." And Secretary Stimson, refusing to scatter the Army and Navy to meet possible sporadic attacks against our coasts, declared that "the only way to prevent these attacks is to mass our forces in offensive action and carry the war to the enemy." The battleships, aircraft carriers, cruisers, destroyers and submarines will be no more important in the kind of agressive war that we shall have to fight than the fleet of small craft which will be needed for attacking enemy vessels in coastal waters and for bringing expeditionary troops and equipment ashore.

In World War I, naval combat motor boats were made of heavy massive wood members and held together by sheer force of strength rather than by any grace of scientific design. Their speed was about 15 knots. There were no landing boats which could carry groups of men and their mechanized equipment through the surf and right up on the beach. Troops were landed in heavy wooden rowboats, their numbers limited by the space necessarily occupied by those who manned the oars; and a sufficient force could seldom be assembled quickly enough to establish an effective beach head. Obviously the need in the small-craft field was for light, speedy, well-designed, motor-driven boats.

Today a New Orleans boatbuilder is using resin-bonded plywood where solid timbers were used yesterday, and providing the United States Navy with motor torpedo patrol boats, landing boats and vehicle carriers which will write a new chapter in the history of the little boat. Higgins Industries, Inc., in company with other modern builders of small

2



3

2—Sleek, swift, ready for business, the U. S. Navy's PT-70 sets forth to avenge Pearl Harbor. The sides of the 76-ft. motor patrol torpedo boat are single panels of resin-bonded plywood. **3, 4**—*Also of plywood construction, the 36-ft. ramp vehicle carrier deposits its passenger solidly on the beach.* **5**—*It takes two flat cars to carry an 84-ft. panel of resin-bonded plywood from Chicago factory to New Orleans boatbuilder.* **6**—*Troops disembarking from these lightweight landing boats don't have to wade through surf, can keep their powder dry*

4

craft, have taken a page from the book of the airplane manufacturers (see MODERN PLASTICS, Oct. 1941, p. 53; Jan. 1942, p. 42) and used plastics and a knowledge of stresses in creating their designs. Side panels, deck planks, bulkheads, partitions and transoms in the Higgins series of motor torpedo boats and 36-foot landing boats and ramp type vehicle carriers are constructed of plastic-bonded plywood, while in windshields and port lights transparent acrylic sheet replaces heavier glass.

The high-speed, triple screw motor torpedo boats are from 70 to 80 feet in length, capable of carrying four 21-in. torpedo tubes, two twin 50-caliber anti-aircraft machine guns and eight depth charges. They are manned by a crew of ten men and can do up to 50 knots. The entire sides of these boats from the sheer to the chine are single panels of plywood. Because of its superior rot-resistance and other desirable properties, Honduras mahogany was selected as the basic material, and is used for practically all of the veneers, including the inner as well as the surface plies. Phenolic resin is used throughout the wood as the bonding agent. Since in a boat of this type, plywood is the principal stress-carrying material, panels are so designed that they can not only carry the initial stresses but can continue to carry the stresses under the most severe conditions of use.

The laminator believes that the 84 by 8-ft. panels which he supplied to the Higgins company are the largest known to the industry. Handling and shipping of these large sheets was in itself no small problem, but to date none has been damaged in transit. The sheets when they arrive at the shipbuilding plant are cut by the template and applied directly to the sides of the boats. The other plastic-bonded plywood members of the boats—deck planks, partitions, bulkheads, transoms—are also fabricated at the plant from sheet stock. The transom, which has rounded corners, is molded in one piece. Also molded of resin-bonded plywood are the machine-gun turrets, in which it is almost impossible to detect a joint.

The qualities which make plastic-bonded plywood ideally adaptable for marine construction are varied. In the first place, its durability is exceptional, because the laminated construction prevents the splitting and cracking to which solid timber is subject. Wood swells, shrinks and splits across the grain, not along it; so by bonding each ply with its grain running at right angles to that of the ply next to it, the strength of the wood can be made to extend both down the length and across the breadth of the panel. This distribution of the grain also enables plywood to hold screws, rivets and other fastenings without splitting. The phenolic resin glue used as the bonding agent is insoluble in water, and proof against dry rot and bacteriological deterioration. Panels bonded with it can stand even continued boiling without disintegrating. Plastic plywood panels are easy to work, available in unlimited sizes, and are structurally strong.

The initial advantage of the resin-bonded plywood combat boat over its clumsier wooden predecessor is one of time gained in the building. Today, more than ever before, time is of the essence; and elimination of much of the caulking operation by the use of plywood makes it possible to build more boats in a shorter space of time. The light weight of the boats has increased their speed threefold, and refinements of design enable the modern combat boat to come in swiftly, turn quickly, fire its torpedoes and (*Please turn to page 102*)

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Shatterproof shields

In private life, acetate-coated wire doubles for glass in poultry houses and solariums. Its wartime rôle: a non-shatterable glass replacer in factory, barrack and private home

THE unsuspected dual nature of many an innocuous domestic article is coming to light as wartime economy supplants business as usual. One normally pacific product now exhibiting militant tendencies is a plastic material used in place of window glass.

Described by the manufacturer as "flexible health glass," this material consists of a 14-screen wire mesh impregnated with cellulose acetate which comes in 25-, 50- and 100-foot rolls and is available in 28- and 36-in. widths. Its primary purpose is to transmit the sun's ultraviolet rays to plants, animals and human beings in seasons when direct exposure is undesirable. The rays most beneficial to mankind occur within the range of 270 to 315 millimicrons, and include particularly the anti-rachitic rays. Acetate-coated wire within this range has a considerably higher transmission than good white crown glass, and it is generally admitted that ordinary window glass does not transmit these radiations.

In its non-belligerent capacity, acetate-coated wire makes windows, doors and skylights of poultry houses and all sorts of buildings for sheltering animals. In the vegetable world, it serves in hot bed and cold frame covers, in greenhouses and sash houses. Porches and solariums, cabins and camps are screened with it. It forms partitions in warehouses and stockrooms, covers for storage bins, and serves as a view medium for tarpaulins and covers for machinery. And all the while it is letting in the light, the acetate-coated wire is shutting out drafts, dust, insects and preventing the escape of heat.

The possibilities of such a material as a protection against air raids were realized when the Nazi bombers came over the British Isles. Windows reinforced with it were able to stand the shock of a 150-lb. bomb exploding six feet away. It can form a detachable screen to fit inside the window pane or be rolled down and held in place like a window blind, thus obviating the necessity for boarding up windows or pasting strips of tape across them. The material comes in cobalt-blue or black for precautionary blackout application. Since the cost of equipping the average window is about $2, it is feasible for use in the room to be set aside for a family air raid shelter, as suggested by the civilian defense authorities.

Steps have already been taken in many quarters to protect citizens from injury by flying debris and broken glass, cause of more injuries than the shrapnel itself. The Board of Education in an East Coast city has purchased enough acetate-coated wire to cover the windows on at least one floor of every schoolhouse. A large hospital is using it in booths erected in the corridors throughout their buildings. A public utility company is employing it as shields for concussion vents. Damage caused by concussion is more extensive than that done by the bombs themselves, and can be minimized in any building by leaving a few windows open to avoid a vacuum.

War industries are also employing the material in varied protective capacities. Partitions made of it in factories where there are frequent minor explosions, such as shell-loading plants and powder plants, topple over easily and are just as easily set back on their feet—no breakage, no expense. Large defense plants going up in a hurry use tall screens of the wire to protect their workmen and their mortar against icy winds so that inclement weather will not delay construction.

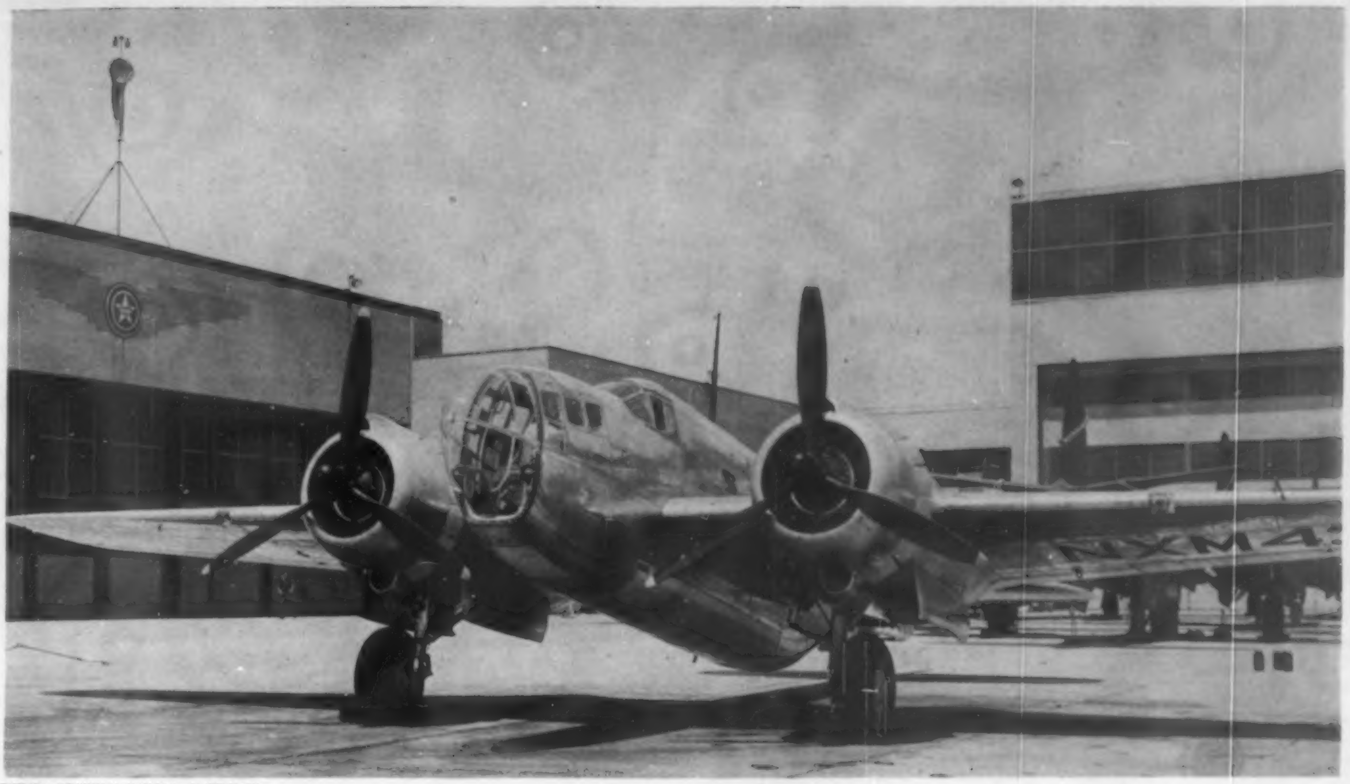
Our Government is making use of it in the building of cantonments and barracks; in aircraft hangars; as screens on gunnery ranges, and in other places where it is essential to let the sunlight in and keep the elements out.

The plastic material is simple to install. It can be nailed into place over the opening to be covered like ordinary wire netting, or applied to a detachable frame to be swung on hinges or lifted in and out like a conventional window screen. In such cases, it is essential to have a loose-fitting frame which will take the concussions that follow a bomb explosion. It can be cut to shape and bent to position, and will take any kind of paint, either sprayed or lacquered. There is no breakage bill, as with window glass, and the material is nonflammable. The strength and toughness of cellulose acetate make it a rugged and wear-resistant glazing medium, and it won't shrink, stretch, curl or warp.

A continous roll of cellulose-acetate coated wire tacked across a window serves as protection against flying glass if the window pane should be shattered during an air raid

PHOTO, COURTESY CELANESE CELLULOID CORP.

Credits—Material: Vimlite, by Celanese Celluloid Corporation.



PHOTOS, COURTESY GLENN L. MARTIN CO.

1—*Pulse of the sleek, high-winged Martin 187, called the "Baltimore" by the British, is a unique molded-macerated, molded-laminated antenna mast. The tapering lightweight support, set on the rear of the plane, blends with its streamlined contours*

The "Baltimore" mast

COMMUNICATION, cooperation, coordination—three essentials for integrating the fast-moving combat units dispersed over wide areas of land, sea and air. The success of modern attack strategy and defensive action depends on the availability of complete instantaneous information concerning rapidly changing situations, constant contact of all units with one another and with headquarters. Blitzkrieg has taught us that bitter lesson. Aircraft, in particular, with almost all other means of communication closed to them, must rely on radio.

The use of plastics in the working parts of radio hook-ups, station and receiving systems, etc., is an old story. But the ingenuity and perseverance of aircraft engineers cooperating with plastic manufacturers in creating, designing, testing a vital plastics part and then remaking it, has produced an efficient communication device that has proved its worth in test flight and is being used in actual combat. Glenn L. Martin engineers have perfected a new antenna mast for the recently developed Martin 187, dubbed by the RAF the "Baltimore" (Fig. 1).

The construction of this radio mast in molded-macerated and molded-laminated phenolic materials was specified to realize a structurally efficient, lightweight antenna support. The fact that the use of plastics relieves an equivalent amount of aluminum for other purposes is an additional advantage and, as a matter of fact, plastics permit a substantial savings in weight, with no loss in strength. From the electrical standpoint, the high dielectric qualities of the materials used in this assembly contribute incidental protection.

The history of the mast dates from the summer of 1940. The new tapered streamlined mast was included as one of the new routine design features of the Martin 187 "Baltimore," built for the British Government. The first designs resulted in a tall support assembled in three parts—base, cap and mast tube—an award winner in the 6th Annual Modern Plastics Competition (see Nov. 1941 issue, page 60). The cap functioned as a closure for the top of the streamlined tube and provided for the attachment of the antenna wires. This piece was made from macerated fabric-filled phenol-formaldehyde molding powder for high strength and impact qualities. The base, which serves as the bottom closure and attaching mount, also utilized the superior physical properties of this material, augmented by five laminations of canvas integrally molded around the flange. The thin walled mast was constructed as a laminated tube in the interest of light weight, bending strength and economical production.

However, the terrific stresses set up by wind pressure on bombers apt to cruise at speeds better than 300 miles per hour require a structural member of great stability and strength. The chief difficulty encountered with the mast in test flights

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was a "whip," or excess vibration. This was caused by added loads set up by the weight of the antenna and insulators. As a result, changes were made to limit flutter to a minimum. A 9-in. shorter mast (Fig. 4) was designed to eliminate the whip-lashing effect of the larger mast.

Another improvement suggested by the manufacturer of the mast was the combination of the antenna tip and the tapered mast itself into one integral unit, thus eliminating the separate part formerly inserted for the tip. The mast in its final design is in two pieces, the base and the mast proper. The same materials are used as in the original model. The base (Figs. 2, 3) is of macerated fabric-base phenolic molding material with a 5-layered laminated fabric preform molded into the macerated material over the area of high stress concentration. The mast proper is, of course, woven fabric wrapped on a streamlined tapered mandrel and impregnated with phenol-formaldehyde resin. The remarkable uniformity of wall thickness in this tapered tube is the result of exceptional care and precision in setting up the laminations and in compression methods.

The tapered streamlined shape effectively produced by the use of plastics results in low aerodynamic drag, which is of fundamental importance to the mast's application on aircraft where the power required to draw a protuberance through the air can mount to considerable magnitude. Furthermore, the faired and flush contours of this shape blend with the flowing lines of the body to which it is attached, and do not unnecessarily detract from the general appearance of the sleek plane.

Another unique feature of the hollow plastic mast is that a sense antenna for a radio direction finder can be installed within the tube.

A background of testing

The development of the mast—the first successful tapered support—is a result of the patient pioneering of the Glenn L. Martin design and engineering department in the use of plastics for major parts. Extensive laboratory work preceded actual test flights and even before the first tall mast was perfected a series of tests (six in all) were conducted.

The efficient structural design, including the taper, was developed by the plastics group of the aircraft company's engineering department according to loads specified by the structural design group.

The design loads were equivalent to an actual pull of an antenna at the end of a mast, and uniform loads rearward and laterally along the mast represented air loads designated by British specifications.

In testing, the antenna load is represented by a 200-lb. spring balance pull. The uniformly distributed load was graduated from 15.8 lb. at the top to 55.3 lb. at the bottom, and was applied, according to the angle shown in the test specimens, rearward and sideways at the same time.

Figures 6 and 7 show two methods of applying loads during the static test experiments which produced the original mast. The antenna loads are represented by the spring balance at the thin tip of the mast while the uniform airloads along the mast are represented by weights hung at predetermined increments. The first of these assemblies failed at the base near the mounting hole. Further tests showed that the macerated material did not meet tensile stress requirements and that only 65 per cent of the specified value was attained. Exhaustive material tests were conducted to prove this point conclusively.

In order to avoid costly change in molding procedure it was decided to add a laminated (*Please turn to page 100*)

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2—Molded-macerated base and fairing of the new Martin antenna mast. 3—Under side of the base shows reinforcing structural parts molded in. 4—Assembly of the base and tapered mast showing the smooth finish and flowing lines. 5—Final test specimen of the earlier mast which failed at 120 percent design load. This was considered satisfactory. Note the fabric insert molded into the macerated base. 6, 7—Two methods of applying loads on the mast during static test experiments which preceded actual production. The wide end of the mast is fastened to a girder at the right, and weights hung along it to represent airloads and antenna attachments

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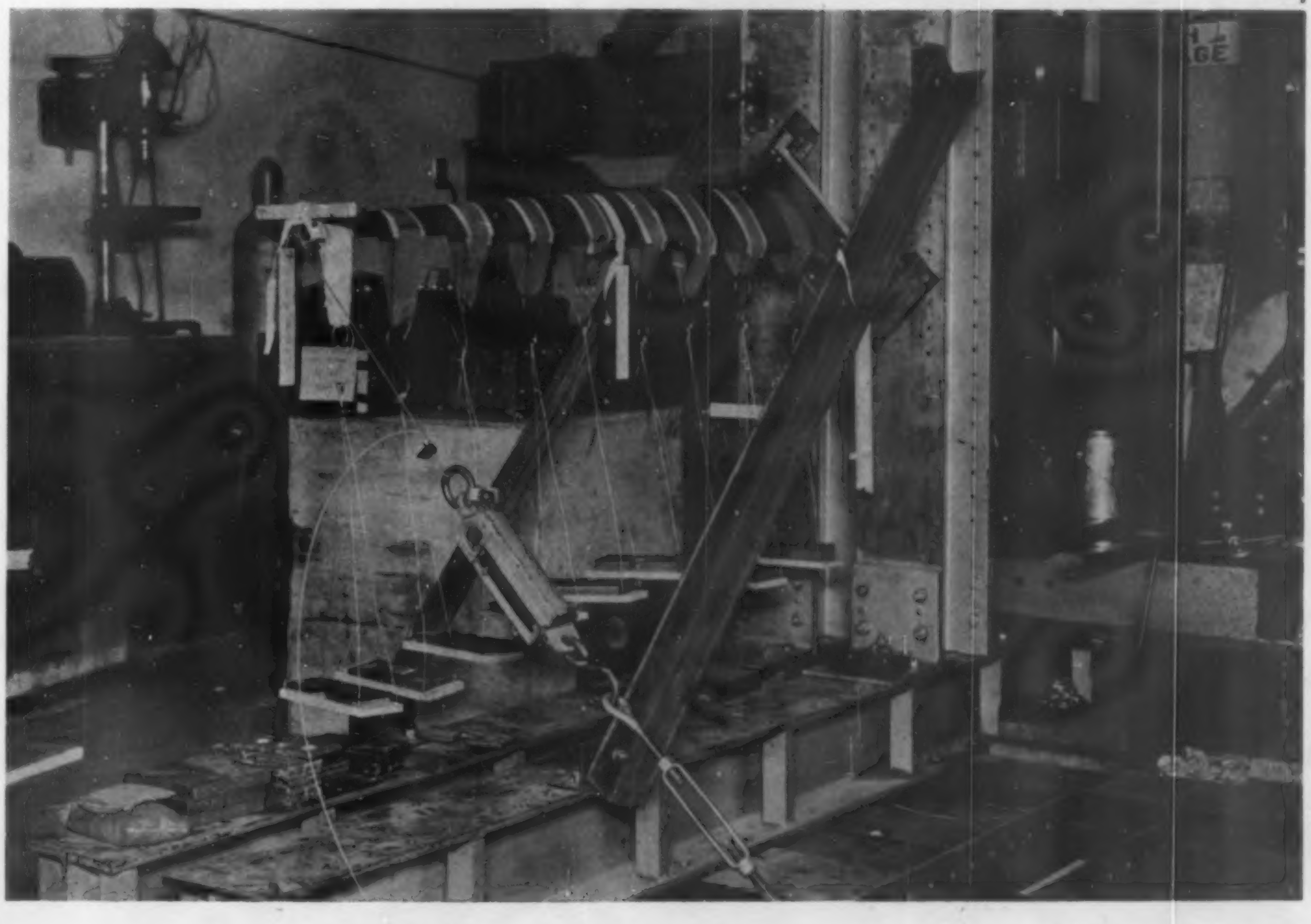

Passing the bottle

Laminated plastic edging on dials and guides of bottling equipment reduces breakage, scarring and noise

"POP," soft drinks, or carbonated beverages are as much an American habit as the daily cup of tea is an English tradition. The huge quantity production of innumerable brands and flavors, each in its distinctive and usually well-advertised bottle, depends on mechanically perfect, planned equipment.

Modern beverage bottling equipment operates at extremely high capacities. Today, speed of production is one of the important requisites of bottling machinery, but appearance of the finished package, economy in handling, reduction of breakage losses and the utmost in smooth, quiet operation cannot be overlooked. Therefore, bottling equipment engineers were not slow to realize the value of laminated plastics in helping to protect bottles traveling through the machines.

It is not uncommon for one bottling machine to produce as many as 200 or more full 6-oz. bottles per minute. This means bottles are being filled at the rate of more than 3 per second. In addition to keeping these comparatively fragile bottles intact—breakage of bottles is always considered a dead loss—preservation of trade marks, labels, applied color, lettering and the smooth surface of the bottle itself is imperative. The bottler cannot afford excessive rejects and must make every use of sales appeal to help back his product's taste appeal.

Fig. 1 shows bottles being moved on a conveyor chain into a filling machine. To *space* and *time* the bottles correctly for placement under syruper, filler and crowner units, they are conveyed into the pockets of rotating dials which engage them, propelling them through the processes of the machine. It is this automatic handling of the bottles which must be carried on with extreme care if speed is to be maintained, undue breakage or scarring of bottles prevented and the din of handling minimized. The latter is an obviously important factor, since most production experts are aware that workers' efficiency and morale are considerably impaired by excessive noise.

Therefore, the type of material used on the dials and guides contacting the bottles is important in helping to bring about the realization of these ideal conditions, and also in resisting normal wear plus the cutting (*Please turn to page 98*)

PHOTOS, COURTESY CROWN CORK AND SEAL CO.

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1—*In the bottling plant, bottles travel through the various stages of washing, filling, mixing, crowning and labeling at speeds up to 200 per minute. The laminated plastic edging on the dials and guides of this equipment minimizes noise and damages*

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2—*Closeup shows the propelling dials and guides which contact the bottles, completely edged with tough laminated phenolic (dark areas)*

PHOTO, COURTESY DOUGLAS AIRCRAFT CO., INC.

1—Salutes from a group of Douglas Aircraft workers, costumed for come what may! Transparent plastics forms the view medium of the horrendous headgear worn by welder, sandblaster, "cold-room" research man, fireman

Protection for production

by S. A. BELL*

THE year 1942 will see the U. S. converted into one huge factory, producing on a scale never before attempted by any nation on earth. For this gigantic task, there were 40,749,000 workers enrolled by industry in general at the end of the third quarter of 1941—3,000,000 more than at the height of the boom era of the 1920's—and their numbers were increasing daily.

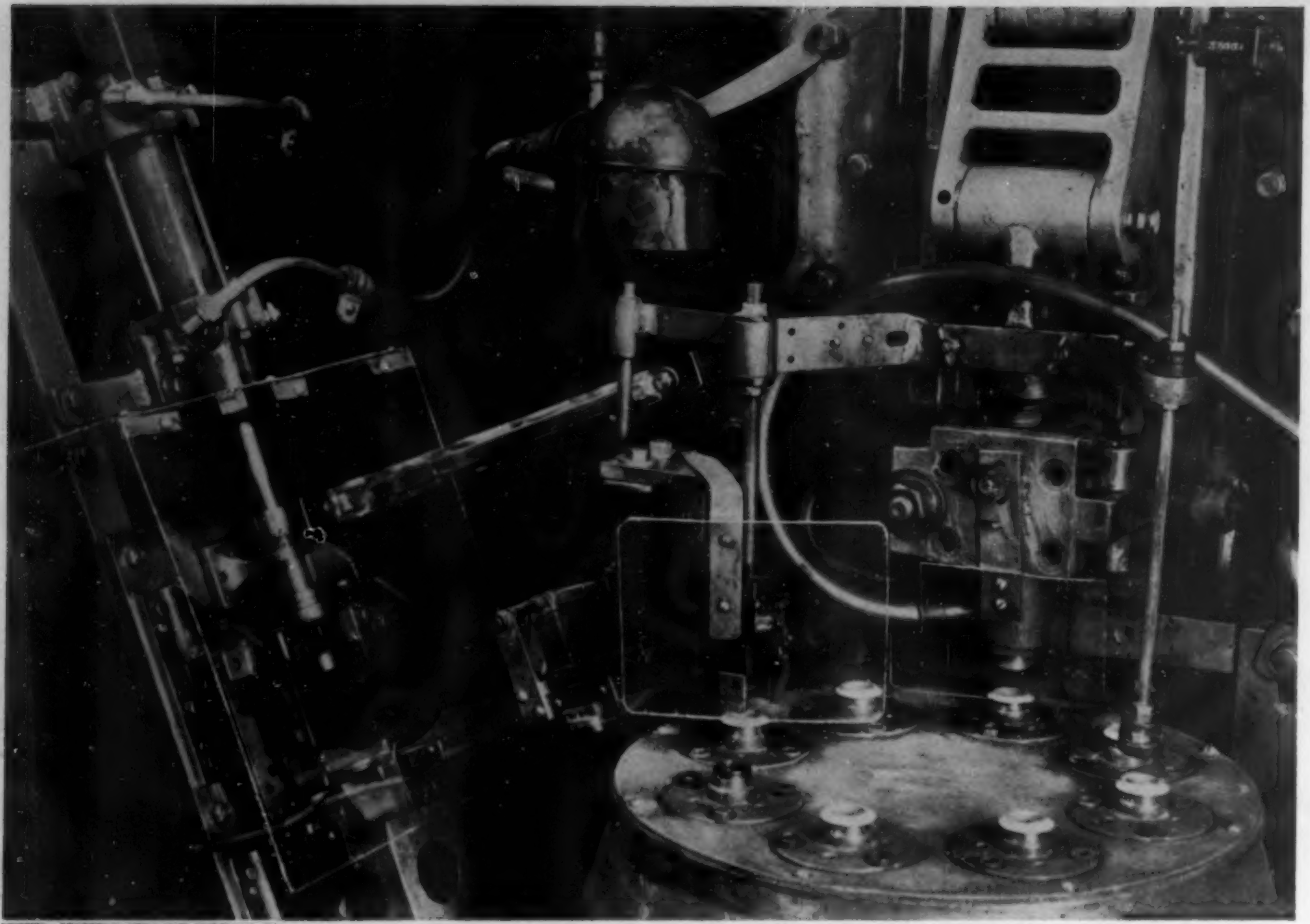
Causes of industrial accidents

Although final records have not yet been compiled, preliminary figures show that fatal accidents in industry increased by 1500 during the calendar year 1941. Factors contributing to a rising industrial accident rate are inherent in increased and accelerated production schedules: Greater total number of hours worked; employment of older men and many very young men at new jobs in war industries; overcrowded conditions in some factories; speeding up of processes; overfatigue from long hours; placing of old machines back in operation; and less careful inspection of machines used in multiple shifts.

To produce the 60,000 planes, 45,000 tanks, 20,000 anti-aircraft guns and 8,000,000 tons of merchant shipping called for by the President in his message to the Congress, and at the same time supply civilian needs for essential consumer goods means that no time can be wasted. To avoid the loss of man-hours entailed by industrial accidents, greater attention must be paid to safety engineering.

Industry has long recognized the place of safety devices in any well-regulated plant. Work proceeds slowly and is often of inferior quality when an operator is afraid of his machine, and production costs rise accordingly. Insurance rates are tied in with accident incidence. Goodwill, that intangible without which no concern can operate successfully, is not improved by lurid newspaper accounts of plant accidents. *(Please turn to next page)*

* Sheet materials sales manager, Plastics Div., Monsanto Chemical Company.



PHOTOS, COURTESY MONSANTO CHEMICAL CO.

2—Heavy gage transparent cellulose acetate sheeting is installed as weld-splash guards on automatic welding equipment in the plant of the Ken Rad Tube and Lamp Company. The plastic protects operator from sparks and molten metal, and can be bent to shape

Because each industry—and, indeed, each individual plant within the industry—presents its own safety problems, safety engineering cannot be standardized, and is constantly searching for new materials and methods for eliminating occupational hazards. That various plastic materials are the safety engineer's answer to certain of these problems is apparent from their record of performance in establishments where they are now in use. Take, for example, the experience of a manufacturer of radio tubes:

Automatic electric welding machines, used in producing the tubes, emit a shower of sparks and molten metal that endangers their operators and all other workers who step within their range. Bulky fireproofed clothing often interferes with the operator's efficiency; and glass shields, while they cut off the weld splash, become so pitted after a few days' use that visual inspection of the welding operation is difficult. The manufacturer, searching for a transparent material that would resist the pitting action of the flying metal, experimented with cellulose acetate sheet and found that its characteristics (transparent, slow burning, non-shatterable, lightweight, easy to bend and form) made it eminently practical for the application. From the point of view of costs, the cellulose acetate shields approximated the protective goggles formerly worn by the operators, and lasted from five to twenty weeks instead of having to be replaced at frequent intervals because they could no longer be seen through.

Stationary guards

Transparent cellulose acetate has been used with success for safety devices on numerous other varieties of industrial machine. Its light weight, non-breakableness and flexibility make it ideal for guards on moving equipment like punch or stamping presses where continual jarring might set up fatigue that would cause failure of other materials. Plastic guards have functioned for long periods without breakage, and have been replaced only when their surfaces became scratched from hard usage.

Because cellulose acetate comes in a standard size sheet 20 in. by 50 in., it is used to box in completely some types of operation, such as cleaning, buffing and de-flashing, thus shielding workers from flying material or liquids, protecting equipment and processing from contamination and keeping the premises clean. The acetate sheet may be cut, sawed or drilled with ordinary woodworking tools, which makes it peculiarly adaptable for applications where individual problems must be worked out by safety engineers and the material shaped and fitted to its task.

Testing equipment and laboratory analysis equipment need to be sealed in so that dust and foreign matter will not contaminate the process and wear down the moving parts. At the same time, it is necessary that the technician have a full view of the mechanism. Transparent cellulose acetate can be cut and shaped to form non-breakable windows which

will fit the complicated openings of many machines of this type.

Whirling saws, cutting their way through tough material, present another safety problem that has successfully been met by cellulose acetate guards. The cutting operation is clearly visible to the worker through the transparent shield, which serves to deflect the shower of cuttings and the water spray if wet cutting is performed. Danger to the operator from a chance bursting of the saw blade is minimized by the tough, resistant plastic, which will absorb a portion of the force of the flying steel slivers.

Processes which call for deflashing or rough trimming also scatter splinters and jagged pieces which may injure the workman, who must stand close enough to the operation to observe it carefully. Here again a transparent plastic guard may be curved around the work area to protect the operator's face—and incidentally to keep the debris off the floor. The construction of such guards is facilitated by the ease with which cellulose acetate sheets can be formed, riveted and cemented. A single 20 in. by 50 in. sheet of plastic from .040 in. to .080 in. can be bent to form a shield around the top of the receptacle for the flashings and trimmings, and either screwed or riveted in place. A circular lid of cellulose acetate can be cut to fit the top aperture and cemented in place, leaving a sufficient opening for the operator's hands and the parts on which he is working. Flash and trimmings removed are in this way kept within the receptacle provided for them.

Cutting, stamping and pressing operations bring the worker's hands close to moving knives and blocks. Transparent cellulose acetate guards can be attached directly to moving parts of the machinery in such a way that fingers cannot get within the danger zone. The stepping-up of production in plants where plastic safety devices have been placed on this type of equipment has been attributed by safety engineers to the operator's lessened fear, either conscious or subconscious, of his machine.

In the manufacture of high-wattage lamps, the men who inspect the filament while it is under full load must have their eyes protected not only from the abnormally bright light but also from flying glass in case a lamp should burst. Safety engineers have estimated that 98 percent of the reputed 1000 daily accidents to U. S. workers' eyes are avoidable. In this instance, dark green transparent cellulose acetate shields will cut out the light rays, leaving only the glowing filament to be seen by the inspector. Tough and resilient, they will stop flying glass, and may be formed into shapes to eliminate glare.

Protective gear and clothing

Stationary guards, or those placed on or around machinery, do not exhaust the possibilities of plastics in accident prevention: the worker himself may wear protective gear or clothing incorporating plastic material. Makers of helmets, masks, goggles and face shields are taking advantage of the light weight and high impact strength of certain plastics. A strong helmet may be con- (*Please turn to page 92*)

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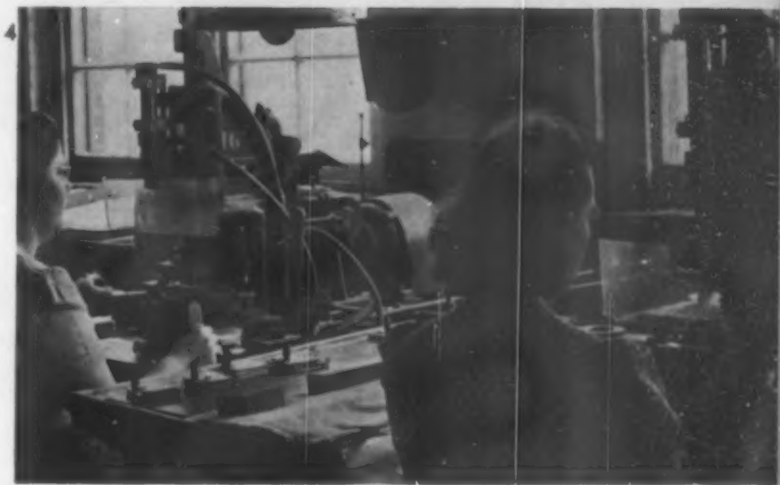

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3—***Example of the fixed type of transparent plastic safety guard installed on a hubbing press. The operator can see perfectly through the clear acetate shield, but the opening at the bottom is not large enough to let his hand get within mangling distance of the machine.*** **4**—***Acetate guards on small hydraulic presses descend with the power ram.*** **5**—***A cut-off saw has a clear plastic safety guard which protects its operator from flying particles, splashing liquid***

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X-ray diagnosis

by R. T. FOREMAN*

Technicians are peering into plastic interiors, analyzing their structures and locating weak spots

THE prominent position of plastics in the military picture and in the realm of vital civilian supplies has placed enormous burdens on the industry, which must provide accurate data on physical properties of its products and maintain their high quality and constancy. X-ray examination can be called upon to simplify this problem, and will help to eliminate waste of man and machine hours—so important in war production.

X-ray technique is out of the rookie stage in industry. During World War I, x-rays were used to detect flaws which might result in disastrous failure of equipment such as high-pressure boilers, and vital power mechanism like turbines, flywheels, valves, etc. At its plant in Covington, Kentucky, the Kelley-Koett Mfg. Co. set up x-ray equipment which was used by industries located in neighboring Cincinnati, Ohio. Thousands of vital castings and forgings were checked before finding their way into ships which kept the sea lanes open. The Army called on Keleket for x-ray equipment to be used at McCook Field (now Wright Field), Dayton, Ohio. Here were constructed model airplanes which were tested in wind tunnels, observers carefully checking the models with x-rays to locate points of weakness in internal wing structure and other concealed parts.

X-ray equipment in use at that time was very bulky. Exposed high voltage lines offered a constant menace to the operator, and a great deal of "stray" x-ray energy emanated from the open tubes. Tremendous strides in design have been made in the last ten years. All high voltage equipment is now immersed in oil in sealed containers. High voltage is carried to the tube in flexible insulated cables, encased in a metal sheath connected to the ground. X-ray tubes are immersed in oil, greatly reducing the size of their metal containers and protecting the operator from high voltage shock. Operator protection is carried still further by providing lead-lined booths for use while films are being made. The result of these precautions is that workers in x-ray departments are said to enjoy excellent health and suffer no ill consequences if they observe the necessary simple precautions.

In the two decades following World War I, x-rays were increasingly used with the same thought in mind: to detect flaws and prevent failures. At Boulder Dam the huge penstock pipes, 30 feet in diameter, were welded as each section was installed, and examined with x-rays immediately after welding. More than 270,000 feet of x-ray films were used in this location, and it was possible to re-weld suspicious joints and forestall failure at some later date when repair would be difficult or impossible.

Acceleration of the demand for plastics in war production has imposed enormous burdens on the industry, and x-ray analysis is helping to meet this demand by providing a ready method for non-destructive testing of plastics. Although much information can be secured by electrical and magnetic analysis of metals, this method is of little value in testing plastics. Photomicrographs yield valuable data in laboratories examining plastics, but the x-ray method goes far be-

* Sales Dept., Kelley-Koett Mfg. Co., Inc.

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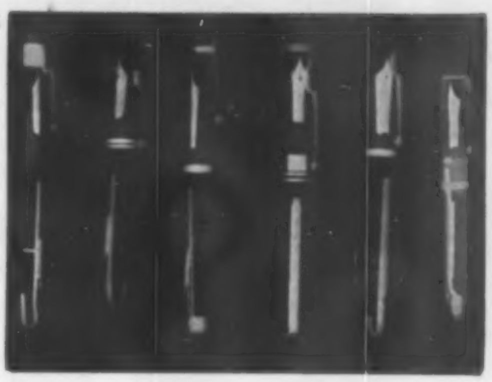


1—Typical apparatus used for the diffraction analysis of plastics. A vertically mounted x-ray tube throws a pencil beam on the specimen, which casts its shadow on the film supported in special holders on the unit. Equipment is shockproof. **2**—*Final inspection of plastic sheeting as it moves on a belt past the x-ray tube and fluoroscopic screen.* **3, 4**—*Inspection unit built around a conveyor belt carrying finished cartons to shipping room. At left, operator release foot pedal to eject any item which looks suspicious. Girl at right opens cartons which come through the chute, fluoroscopes their contents.* **5**—*Fountain pens x-rayed to inspect the positioning of the metal parts in the plastic*

yond the limit of the microscope. Diffraction analysis, the technical term designating a special form of x-ray examination, makes it possible to peer into the very composition of matter and visualize the arrangement of molecules. When a sample of any plastic is placed in the path of a narrow pencil of x-rays, reflection occurs from each molecule, and the film records an image whose shape depends on the molecular arrangement of the material.

Equipment required for this type of examination is very simple, a typical arrangement being shown in Fig. 1. This equipment is shockproof and gives excellent results in the hands of the average laboratory employee. It consists essentially of an x-ray tube mounted vertically on the axis of the cylindrical housing. A specimen is placed in the path of a pencil beam of x-rays and casts a shadow on the film, which is supported vertically in special holders mounted on the unit. These shadows may be readily interpreted on the basis of available data.

One of the most useful facts, and one most easily determined, is whether a substance is crystalline or amorphous. Other types of examination are very uncertain, especially microscopic examination of extremely small particles. The x-ray pattern identifies such material at once, proving its crystalline structure or labeling it unquestionably as amorphous. Similarly, as any material is deformed by bending or machining, x-ray examination indicates whether it remains uniform in structure or undergoes changes which may result in failure at a critical point. Diffraction analysis is invaluable to those charged with controlling the composition of existing plastics and of creating new ones.

Contrasted with this type of analysis, concerned primarily with molecular structure, is x-ray examination of finished parts. For this purpose, industry uses conventional x-ray equipment, both radiographic and fluoroscopic. In radiography, the object under study records a shadow on a special film which produces a permanent record. In fluoroscopy, the x-ray beam is used to produce fluorescence on a special screen, coated with an emulsion which emits visible light when excited by x-rays. The object is frequently moved past the fluoroscopic screen on a belt, permitting rapid examination to determine the presence of foreign bodies, improper molding, other types of flaws.

Figure 2 shows an arrangement of this sort, in which a plastic sheet is placed on a belt, moved past the x-ray tube and fluoroscopic screen and examined for imperfections. Since the fluoroscopic unit is isolated from the production line, x-ray examination is a distinct step in final inspection.

Figures 3 and 4 are two views of a unit built around the conveyor belt which carries finished packages to the shipping room. Figure 3 illustrates the *(Please turn to page 92)*

Luminous dials and knobs

Lots of fast planes in a hurry is the No. 1 need of the United Nations today. Injection-molded plastic knobs and dials for instrument panels of Curtiss-Wright planes have a molding cycle of less than one minute! Composed of cellulose acetate butyrate, a non-critical material, the finished pieces weight 50 percent less than their engraved metal predecessors. The "three-dimensional" molding method achieves an effect of depth and improved legibility. First, they are molded in clear plastic with the lettering and characters indented in the rear surface. Next, the characters are coated with a specially developed fluorescent material which glows when exposed to invisible ultraviolet light. Finally, the entire rear surface is covered with a special paint which will not reflect light.

Because the luminous paint is applied to rear surfaces, neither it nor the background paint is subject to surface wear, resulting in a longer life. In the upper photo, a group of dials as they look in daylight; below, their appearance under ultraviolet light in the dark. The clear, unpainted plastic dial, shown as it comes from the injection press, is naturally invisible in the dark.

Credits—Material: Tenite II. Designed by Engineering Dept., Curtiss-Wright Corp. and Plastics Div., Erie Resistor Corp., the molder

Product Development

Corrosion-proof equipment

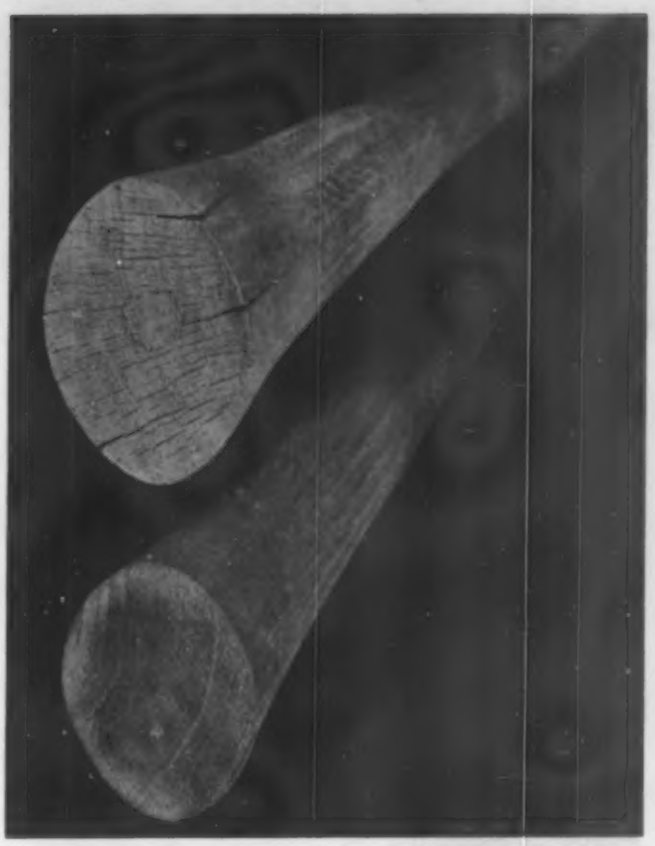
Municipal laws against the exhausting of queer-smelling and highly corrosive fumes into the atmosphere have stimulated the development of methods for "killing" them. Because such vapors may usually be absorbed in water, preparers of chemicals, fertilizers, paints, food products and the like use condensers for disposing of obnoxious fumes given off by their processes. In the type of installation shown here, the pressure liquid (water or steam) enters at the top of the condenser (the large item at the left) and discharges in the shape of a strong but well-divided spray. The jet action of the spray induces a flow of vapors into the body of the condenser, where they are condensed and discharged into the sewer.

The body of this obnoxious vapor condenser is molded in one piece of a phenolic resin asbestos composition which is strong, tough, durable, acid- and corrosion-resistant. In particular, the plastic is immune to practically all types of chemical fumes and able to stand thermal shocks.

Of the same plastic material, chosen for the same reasons, are the two steam jet exhausters at the right, used in this particular plant to create a vacuum for raising and lowering hydrochloric acid, and for moving it from tank to tank. Exhausts can be adjusted to almost any pressure.

Credits—Material: Haveg. Molded by Haveg Corp. for Schutte & Koerting Company

Seasoned lumber



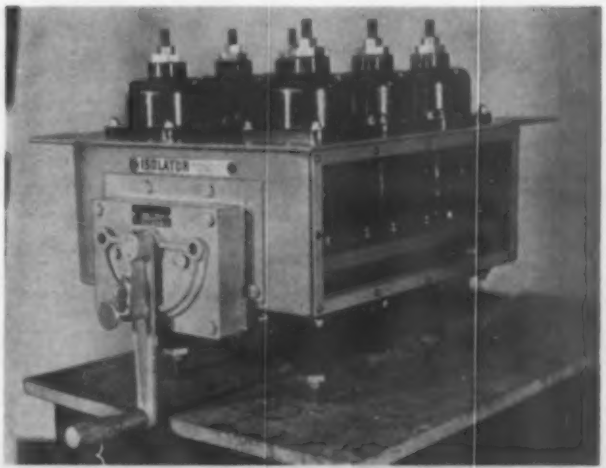
Time and timber, both valuable today, may be saved by seasoning green lumber with urea, which shortens its drying time in the kilns and reduces lumber losses due to cracking and splitting. Lumber-mill experiments made with the chemical have shown that it prevents the surface of the lumber from shrinking and developing tension stresses, yet will not discolor it, corrode metals used with it, dull woodworking tools or promote insect attack. The urea may be applied to the lumber by dry spreading, soaking, dipping or spraying. Wood is then dried either in the open air or in kilns, where the seasoning time can be hastened by controlled temperature and humidity. The urea is said to reduce shrinkage of fibers and keep the outer zone of the wood moist and swollen as it dries from the inside out, thus avoiding cracking, splitting or warping. The untreated hickory pick handle at the top of the photograph shows these seasoning defects, which do not appear in the urea-treated handle at the bottom.

In its study of the impregnating of wood with urea, the Forest Products Laboratory at Madison, Wis., found that lumber so treated and dried will, if subsequently heated to 210 deg. or higher, become relatively plastic. If bent while hot, it will retain its new shape after it cools.

Credits—Urea by E. I. du Pont de Nemours & Co., Inc.

Product Development

Disconnecting switch



Engineers are tidy men who like their equipment to be compact and not clutter up the place. The self-contained, efficient looking device above disconnects high voltage circuits at a power station switchboard, where the physical properties and molding qualities of its plastic parts are partially responsible for its businesslike dimensions.

The Isolator is a modern streamlined disconnect switch, not a load breaker. Its contacts consist of an upper and lower stationary stud and a center movable sleeve, each enclosed in a molded bushing. In the open position, the movable sleeve and bushing are both telescoped with the lower stud and bushing, leaving a visible open gap between them and the upper bushing and stud. When moving from open position to closed position, the movable sleeve and bushing telescope with the upper stud and bushing, making contact yet remaining telescoped with the lower stud and bushing and completely enclosing all current carrying parts.

Former Isolators had insulation of wet process porcelain, which is still used in units which are involved in voltage ratings over 5000. When the rating is 5000 volts or under, the units now have bushings of molded phenolic.

Credits—Material: Durez. Molded by Midwest Molding & Mfg. Co. for Electrical Engineers Equipment Company

Cellulose acetate yarn for wire insulation

by D. R. BROBST*

1

2

Current interest in the use of plastics for insulating purposes prompts us to reprint for the benefit of our readers this article from the January 1942 Bell Laboratories Record. Mr. Brobst has for twenty years worked with textile insulations, including a cellulose acetate lacquer for the textile covering of central-office wires.—ED.

FOR years silk has been one of the most desirable textile materials for insulating wires for electrical purposes. It has been particularly satisfactory for telephone central-office wires because of its stability in electrical characteristics under varying atmospheric conditions, and its good aging properties.

The types of wires most widely used for interconnecting apparatus in central offices include three classifications: switchboard wire, which is used in hand-formed local cables to connect closely associated apparatus; switchboard cable wire, which is used in grouped units with a common covering to connect equipment more or less widely separated within the central office; and distributing-frame wire, which is supported loosely on metal frames and used for equipment connections which may be changed at frequent intervals.

For many years after the beginning of the telephone industry, silk was used in all of these wires, usually in double layers and covered with cotton. However, supplies of silk were often uncertain and the cost high, particularly during periods of unsettled world conditions. For these reasons, it was found desirable, in recent years, to employ two grades of insulation in switchboard wires and cables. The lower grade insulation was used in local circuits and was composed of two wrappings of cotton and a cellulose acetate lacquer coating. The higher grade insulation was used in toll circuits and consisted of two wrappings of silk, one of cotton, and a cellulose acetate lacquer coating.

Distributing-frame wire has an enamel coating on the conductor, two wrappings of silk, a wrapping of cotton and a lacquer coating. The addition of enamel to the insulation in this wire is designed to provide for the more severe handling to which this wire is subjected in service.

The type of silk which was used in these wires is known as spun tussah. It is made from the cocoons of wild silk worms and utilizes the short lengths of fibers discarded after the continuous filaments from the cocoons are used for higher grade textiles. It is a product of China and its importation has been practically stopped by the Sino-Japanese War. It was therefore necessary to obtain a satisfactory material to substitute for the silk.

Ever since the introduction of synthetic fibers in the textile industry, consideration has been given to the possible use of these materials for electrical insulating purposes. The desirability of obtaining a rayon or similar material for use in place of silk is indicated by the (*Please turn to page 98*)

* Technical staff, Bell Telephone Laboratories, Inc.

1—Samples of wire insulated with several different types of fiber are wound on brass tubes, exposed to high humidity in a test cabinet, and their insulation resistance measured. 2—Measuring electrical characteristics of fiber-insulated wire samples which are in an adjoining humidity room

1—Corona lighting units with molded urea reflectors are used throughout the Federal Loan Agency Building, Washington, D.C. 2—A variety of adapter-type reflector used with molded ceiling fixtures and all types of wall shades is being used in housing projects (3) and in the merchant marine

PHOTOS, COURTESY PLASTICS DIV., AMERICAN CYANAMID CO.

1

Spreading the light

As essential to the war effort as military and vital industrial expansion, a huge program of increased construction of housing units, community facilities, army camps, schools and hospitals has been planned to promote civilian welfare. One obvious factor in production at top speed is the fitness and sustained efficiency of the workers. Bad lighting—causing eyestrain with its train of evils, including aching eyes, headaches, nervousness and other disturbances—tends definitely to retard progress. Modern lighting in the shops and offices of the war plants eliminates this during working hours, but inadequate or glaring illumination in the workers' homes or in the places in which they seek their recreation can seriously affect the store of energy that must be accumulated in off-duty activity.

Recognition of the importance of correct lighting as a factor in maintaining public health and morale, plus the need for further limiting the applications of copper, brass and other metals used in the production of lighting fixtures, has given added stimulus to the applications of plastics for lighting—not only in reflectors which are old standbys but in manufacture of fixtures as well.

Ideal for portable lamps as well as for stationary fixtures, molded urea reflectors are shatter-resistant, meet standards of lighting efficiency and are surprisingly inexpensive. Composition and color of the translucent reflectors can be chemically controlled to secure maximum transmission and diffusion of light with low surface brilliancy. Thus harsh glare is eliminated and a soft light (*Please turn to page 94*)

2

3

Molding a phenolic-sisal product

by H. C. NELSON, JR., and L. D. REED*

CO-RO-LITE is a combination of Co-Ro-Felt and phenol-formaldehyde resin solids. Co-Ro-Felt is a fluffy, springy batting of sisal fibers firmly held together by tufts of fibers uniformly needled through it. The batting is impregnated by "dunking" it in a resin varnish and squeezing out the excess. Oven drying gets rid of the solvent and advances the resin to the "B" stage.

This article is limited mainly to molding operations with Co-Ro-Lite No. 1100, which consists of 40 percent phenolic solids and 60 percent sisal fiber. It should be pointed out, however, that various other resin solids, many of a thermoplastic nature, have been incorporated successfully with the batting, and the resulting products are available for special applications.

The phenolic sisal material in sheet form is moldable into irregular shapes without sacrifice of strength, due to the length and binding power of the fibers as well as to their closely knit condition. In fact, so well is the filler needled that the material possesses an elastic springiness which permits curing to various densities. The back pressure resulting from the resistance of the phenolic sisal sheet to compression makes it possible to cure the resins before it attains maximum density. In brief, the phenolic sisal product combines the moldability of macerate-filled plastics with the strength and impact resistance of laminates.

The application of the phenolic sisal material to most molding jobs is essentially a matter of employing laminating technique. The specific gravity for a given thickness is dependent on the number of laminations employed by the molder. The fact that it can be molded to various densities makes possible the use of plastics for parts where strength as well as low weight is desirable. Many plastics, although of good strength and impact characteristics, are too heavy for use in certain applications—for example, airplane parts.

* Allied Products Div., Columbian Rope Co.

TABLE I.—PHYSICAL PROPERTIES OF CO-RO-LITE 1100 IN VARIOUS SPECIFIC GRAVITIES

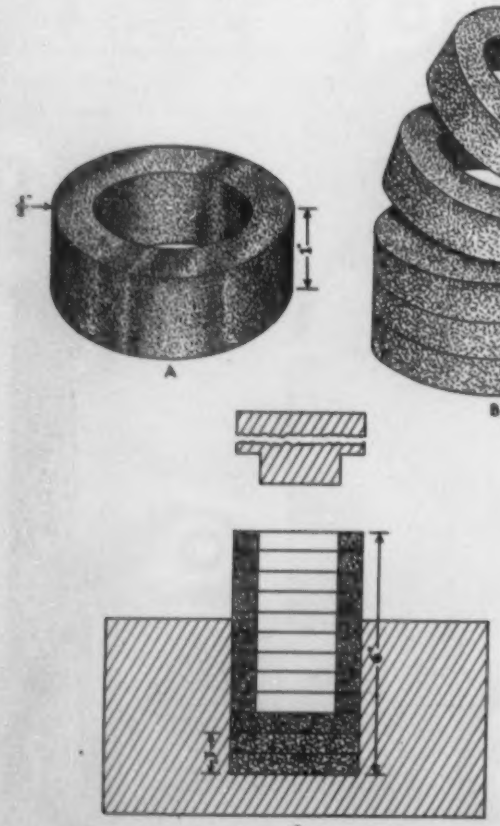
	High density	*Medium density*	*Low density*	*Very low density*
Specific gravity	1.33	1.12	0.90	0.71
Impact strength (Charpy), ft.-lb./in. of notch	8	9.6	8	4
Flexural strength, lb./sq. in.	18,000	21,000	13,500	7,800
Modulus of elasticity, lb./sq. in.	800,000	870,000	695,000	450,000
Tensile strength, lb./sq. in.	11,000	12,000	8,300	5,600
Bulk factor	6-1	5-1	4-1	3-1

However, varying the density results, as might be expected, in variation of physical properties and this must be considered before molding operations are undertaken. Table I presents the results of physical tests on molded specimens of various specific gravities.

Table II indicates the number of laminations which should be employed to obtain a given thickness and a specific gravity of 1.30 to 1.35. The table also gives the time required to cure such products at 300 deg. F. Note the two columns of curing times, one for laminating between platens and one for closed mold curing. Naturally, a longer time is required for curing laminates because a great deal of heat is permitted to escape in the air which circulates between the press platens and also by radiation from the stock itself. A closed mold holds the heat. These curing times are not rigidly set but are presented herewith as a sort of guide to users of the phenolic sisal product. Faster curing is obtained by using higher temperatures. However, it is advised that *no temperatures higher than 330 deg. F. be employed*, because above this the fibers are apt to oxidize partially and thus greatly reduce the strength of the material. For curing time exceeding 8 min., best physical properties are obtained with 300 deg. F.

The different stock weights of phenolic sisal sheet specified in Table II are prepared by needling various masses of the

Fig. 1



1A—*Cup, 3 in. in diameter, 1 in. high outside, 3/4 in. deep inside and 1/2-in. walls.* **B**—*Start of assembly for molding cup shown in* **A**. *The 3 disks for the bottom are in place and 2 of the 9 rings are almost in place.* **C**—*Cross section of assembly of phenolic-sisal preforms in mold. Bulk factor is indicated as 6. Obviously a positive type mold is necessary to avoid top-heaviness of the assembly*

sisal fibers together. Table III shows weights of batting and the corresponding phenolic sisal sheets which are available. It is also possible to obtain special needled weights of batting and special weights of resin-impregnated sheet for particular jobs.

In molding a circular disk, three inches in diameter and one-eighth inch thick, from the phenolic sisal material, the first step is that of determining from Table II how many laminations of a particular weight material are required for a thickness of one-eighth inch. Table II indicates that two layers of 3 3/8 lb./sq. yd. material are required. The charge is cut in the form of two three-inch circular disks.

Turning now to a more complex molding such as the cup shown in Fig. 1a, it will be seen that, although the technique remains unchanged, the laminations must be of more than one shape. For a one-quarter inch thick bottom, the laminating table indicates three disks of 5 lb./sq. yd. material, three inches in diameter. Since the cup is to be one inch high, nine more laminations of 5 lb./sq. yd. material will be required for the sides. To obtain one-half inch thick walls these latter laminations will be cut in the form of rings three inches in outside diameter and two inches inside diameter (see Fig. 1b). The time required to cure a thickness of one-half inch, also obtained from Table II under closed mold curing, is fifteen minutes. Preforms such as described in the above illustration are supplied ready to charge or may be cut from sheets by the molder.

In designing molds for the phenolic sisal product, the bulk factor must be given particular consideration. It will be noted that Fig. 1c indicates the material to have a bulk factor of six when molding objects to a specific gravity of 1.30 to 1.35, which is quite true of the regular grade material. But when cases arise where arranging the charge of laminations results in a top-heavy stack, cold pressed phenolic sisal sheets with a bulk factor of 3 may successfully be used.

TABLE II.—LAMINATING AND MOLDING CHART FOR CO-RO-LITE 1100

Thickness of finished laminate or molding, in.	Curing time at 300° F. Laminating between platens, min.	Curing time at 300° F. Closed molding, min.	Number of laminations of stock of various weights to obtain a specific gravity of 1.30–1.35: 1 3/8 lb./sq. yd.	3 3/8 lb./sq. yd.	5 lb./sq. yd.	Total layers
* 1/32	8	6	1			1
* 3/64	9	6 3/4	2			2
1/16	10	7 1/2		1		1
1/8	12	9		2		2
3/16	14	10 1/2		3		3
1/4	15	11			3	3
5/16	15	11		1	3	4
3/8	18	13 1/2		2	3	5
7/16	18	13 1/2		3	3	6
1/2	20	15			6	6
9/16	20	15		1	6	7
5/8	23	17		2	6	8
11/16	23	17	3	6		9
3/4	25	19		9		9
13/16	25	19	1	9		10
7/8	28	21	2	9		11
15/16	28	21	3	9		12
1	30	22 1/2		12		12

* Laminated sheets 1/32 and 3/64 in. thick should be coated on the outside with dry powdered resin to fill in the unevenness of the stock and to give them smoother surfaces.

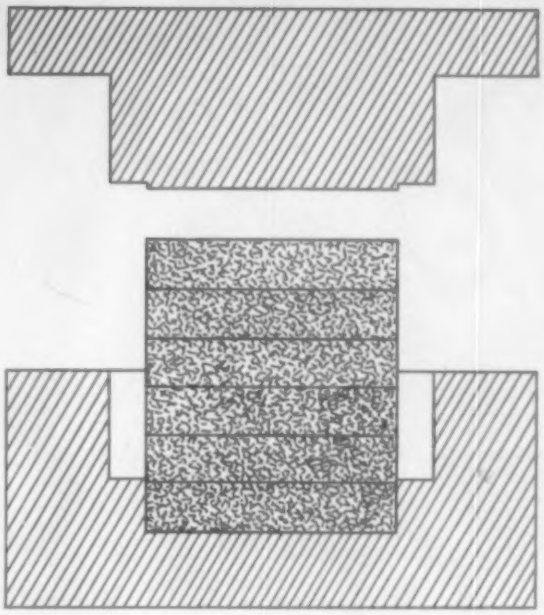


Fig. 2

2—*Cross sectional view of the loading of a semi-positive mold with phenolic-sisal preforms. Note the auxiliary telescoping portion is of little advantage except as a bearing surface tending to decrease scoring of the walls of the positive portion. The molded piece which results is a circular disk 2 5/8 in. in diameter and 1/2 in. thick*

A flash type mold, which is the cheapest to build, should be used whenever possible. If, however, it is apparent that the stack of laminations when placed in this type mold will be top-heavy, even when prepressed to a smaller bulk factor, a positive-type mold should be designed of such depth as to overcome the top-heaviness. Care should be taken with this kind of mold that the pressure is absorbed evenly by the charge in order to avoid fiber rupture. Furthermore, parallels should be employed to limit mold closure.

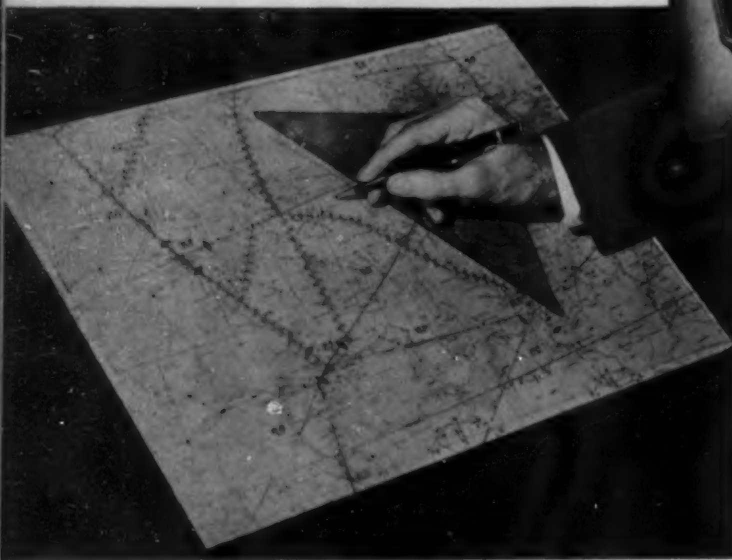
The advantage of using a semi-positive mold with high bulk material in order to obtain loading space is practically non-existent in the case of the phenolic sisal product. On the other hand, because it is in sheet form, most of the disadvantages generally associated with molding material of high bulk factor are also non-existent. The chief difficulty in using a semi-positive mold with the phenolic sisal sheet is that the material sometimes cures on the lands, causing dimensional variations in the pieces. However, rather than build new molds, some semi-positive molds are used at the Columbian Rope Co. Laboratories. Landed positive molds without loading chambers are used, of course, with the same facility as positive molds. Figure 2 shows the loading of a semi-positive mold designed to make one-half inch thick circular disks. *(Please turn to page 90)*

TABLE III.—AVAILABLE WEIGHTS OF CO-RO-FELT AND CO-RO-LITE

Co-Ro-Felt batting, lb./sq. yd.	*Co-Ro-Lite No. 1100 sheets, lb./sq. yd.*
1/2	7/8
1	1 3/8
2 1/4	3 3/8
3	5
5 1/2	9 1/8

Plastics in Review

1



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1 Gleaming heat-reactive Bakelite-base finish on this industrial drying tray protects the metal surface from corrosion and contamination. These trays are used in drying an organic material which tends to attack the metal. Coating is a baked enamel, formulated by Lithgow Corporation

2 Plotting bearings accurately with the aid of radio direction finders, navigators on board planes of the Mid-Continent Airlines mark positions on Vinylite-covered charts. Clear non-warping plastic sheets protect paper surfaces from wear and tear, are easily cleared of pencil or crayon markings with an eraser, and are non-flammable

3 Trouble-saver in the kitchen and a handy double for a stirrup pump, this flexible sink spray will direct cold or hot water spray wherever desired. Colorful handle which conceals spray head is of a water-resistant phenolic and won't damage a porcelain sink if dropped. First plastic parts featured as standard equipment by the Crane Co., the spray handles are molded of Durez in multiple split cavity molds by Chicago Molded Products Corporation

4 A white blackboard! A transparent sheet of cellulose acetate over a sheet of white which covers the carbon back creates this fascinating Magic Slate, made by the Strathmore Co. The sanitary Lumarith surface will wear long after Junior has advanced be-

4

5

yond kindergarten age. Writing is done with a stylus tipped with a Tenite point molded by Gits Molding Corp., and removed by lifting both the top sheets

5 Open sesame to the hardware field! Molded cellulose acetate door knobs are coated with chromium (top) by the Metaplast process to add that expensive look. These tough, practical knobs are also attractive *au naturel* (bottom). They are molded by Pacific Plastics & Mfg. Co. from Hercules cellulose acetate flake compounds

6 A brush for a sweet tooth—large cradle brushes, bristled with du Pont nylon, are employed in commercial manufacture of hard candy to clean the starch used on the sweets to prevent sticking. These brushes sometimes are 8 ft. long with 12 strips of bristles. Confectioners report that bristles will not fray, split or break off, and show no signs of wear after 6 months

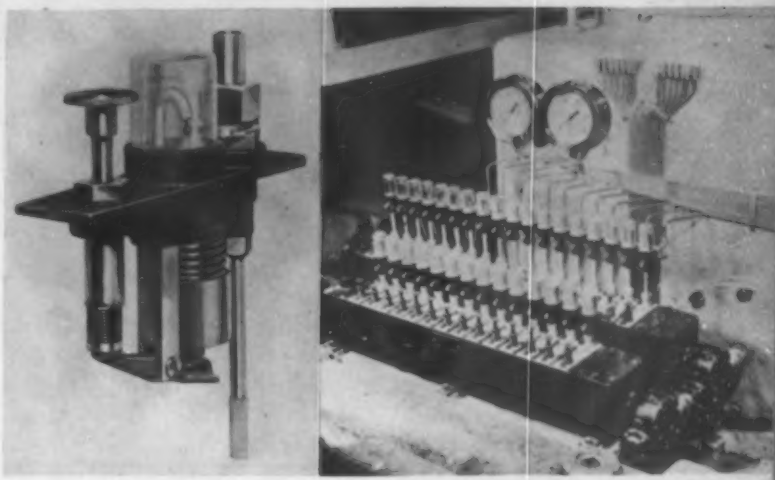
7 An immediate check on delivery of oil from automatic lubricators to industrial engines and compressors is made through transparent Lucite sight feeds (see closeup, left). They provide visibility of oil supply from any angle, are practically unbreakable, and tested to withstand high pressures. Fabricated from clear rods by McCord Radiator & Mfg. Company

8 To show at a glance the status of the entire pumping system, the light-conducting properties of acrylic are used in the Westinghouse bench-type switchboard built for Toledo's new high service water pump control station. The station piping system is represented on the 25 ft. bench by a flat Plexiglas strip, $^1/_8$ in. thick and $^{13}/_{16}$ in. wide, with lights beneath it. When the attendant operates a control switch to close a valve, the plastic strip representing the associated pipe automatically becomes luminous

9 Injection molded Tenite hangers in transparent and translucent colors replace metal and expensively covered types, and have no rough edges to catch delicate fabrics. Duraform style (left) by All-Styles Hanger Co., Inc., has a groove to hold straps of gowns and lingerie and a hook for skirt loops. Thin-walled hangers (right) are reinforced with inner ribs. Both molded by Belmar Mfg. Company

10 Inspired by the flowing lines of modern airplane design, this comfortable blue velvet covered chair, constructed entirely without metal, is supported on two springy hoops of amber Plexiglas. Designed by architect Lewis M. Scott and textile designer Albert Ehrensperger, the chair weighs only 20 lbs. and required only 2 yds. of upholstery

7



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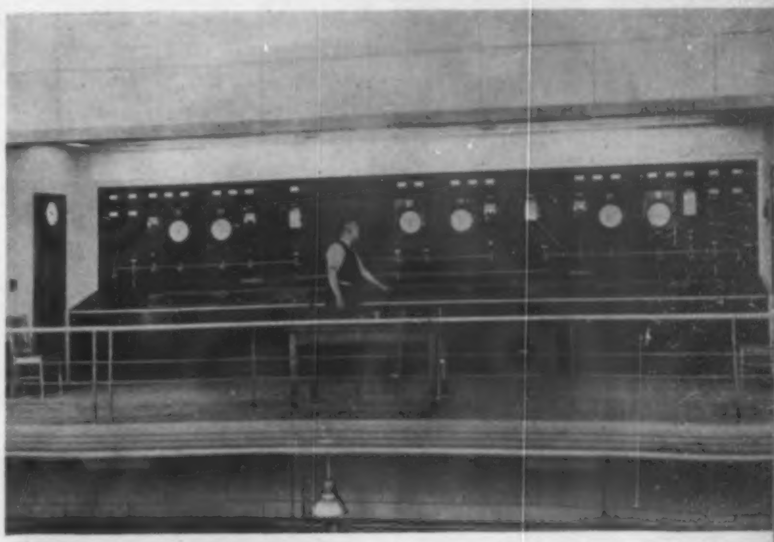

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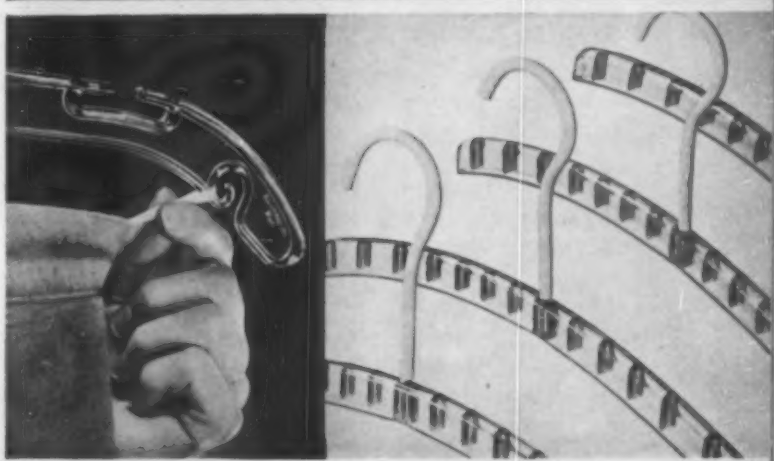

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6

Availability of coloring materials

by WILLIAM H. PEACOCK*

THE manufacture of dyestuffs, like the making of synthetic resins, is applied chemistry and engineering. Accordingly, both industries have many technical similarities. They use the same chemicals and the same types of unit process. It follows, therefore, that the war has affected similarly the raw materials and equipment supply and the final distribution, through priority orders, of the production in both fields.

A few examples may illustrate this similarity. A dyestuff chemist cannot conveniently make certain dyes without using formaldehyde, urea, chlorine or phenol any more than the plastic chemist can make certain synthetic resins without them. The nitric and acetic acids so essential for making cellulose nitrate or cellulose acetate are just as essential in the production of nitrobenzenes, trinitrophenol (picric acid), acetanilide and similar dye intermediates.

The aliphatic chlorides and chlornaphthalenes are used in dyemaking as well as in plastics. Both industries require alcohols, ketones, esters, ethers and hydrocarbons. Stills, pumps, pipe lines, condensers, motors, filters, driers, drums, and many other items of equipment are common needs of both fields. The technicians in each group, therefore, can appreciate the present supply problems of the other. However, it may prove an aid to cooperation to discuss more in detail the availability at this time of coloring agents for plastics.

Like the simplest plastics, the simplest dyestuffs made usually require six or eight different chemicals, organic and inorganic, many of which in turn require an equal number of other materials. The lack or restriction in supply of any one of these chemicals naturally prevents or restricts the manufacture of the dye or plastic.

One of the best examples of these difficulties is in the group of dyes based on anthraquinone as an intermediate. These dyes are among the most useful in the acid, chrome, oil soluble and vat dye groups. Consequently, the need for them is enormous. As anthraquinone is made from phthalic anhydride and aluminum chloride, and as aluminum, chlorine and phthalic anhydride are all wholly or partially under mandatory control, it will be appreciated that there is a definite limit on the quantity of such dyes available.

Another example is aniline, an ingredient of some plastics. From it also are made such products as carbamite (diethyldiphenylurea) and diphenylamine stabilizers for smokeless powders; tetryl (methylpicrylnitramine), the booster charge which sets off TNT; the bulk of rubber accelerators and antioxidants; and all the sulfanilamide class of drugs. Aniline is the basis of scores of dyes very much in demand. Most of the blacks used in the plastic field are oxidized aniline products (nigrosines and other azines). A sudden large new demand has arisen from its use to color blackout curtains and other textiles with aniline black. The aniline supply is just about large enough to take care of current requirements. New plants for its manufacture are being built and will perhaps be brought into production soon enough to provide for maximum war necessity.

Coloring agents requiring in their manufacture the metals on the priority lists are extremely limited in supply. Cadmium reds, chrome greens, chrome and zinc yellows, metallized azo dyes and lakes requiring lead, tungsten, molybdenum, aluminum and tin are short.

The small amount of coloring agents formerly imported from the Axis or Axis-occupied countries has largely been replaced with domestic products, usually to advantage. Enemy-owned "nuisance" patents with broad claims are still being honored, but presumably Washington will, in due course, take appropriate action.

The dyestuff industry in the United States is staffed and equipped normally to fill every real dye need. It makes about 1000 different dyes, drugs, intermediates, catalysts and other products. To do so requires equipment. As they are not made in 1000 separate assembly lines, each batch, as in a plastic plant, is routed successively through the available equipment, with the same timing precision used in dispatching railroad trains and freights. Most of the equipment is specially designed, difficult to obtain, maintain or enlarge.

Under present market demands each batch goes through full size if materials are available. Consequently, some dyes for which requirements are small have been discontinued. It is just as impractical to use equipment to make small dye lots, or those requiring too prolonged processing, as it would be to use a ten-ton truck to take five pounds of freight from New York to California. Fortunately usable substitute dyes are available for some of the discontinued items.

The plastics industry is but one of the large fields requiring dyes. Industries equally as huge and applications equally as important need coloring agents. Our defense bonds, recruiting posters and propaganda pamphlets require colors. Dyes are used in large amounts for signal systems, electrical wiring, flags, uniforms, tents, leather belts, holsters and shoes, inks, carbon paper, camouflage screens, marine nets and even for sand bags.

In view of all these factors, it is reasonable to expect that in 1942 there will be some shortages for civilian use. Accordingly, each order for dyes should state whether the material is to be used for defense or civilian purposes. Government order numbers should also be shown, as these will enable the dye maker to get chemicals for further supplies of dyestuff.

In more specific reference to the plastic field, there is at present an adequate supply of coloring materials for most plastics, particularly for those that used a large volume of dye in 1941. Current needs are being supplied but there is no excess for accumulating stocks. When the newer allocation systems are established on raw and finished materials, dye quotas may have to be revised.

Except to fill some war-born need, or as substitutes for scarce dyes, it is probable that for some time no new dyes will be offered that are based on present intermediates. This does not mean research will be curtailed for, quite to the contrary, research is being intensified. For responsible experimenters, research staffs and technical service trade trials on specific problems, small lots of dyes will still be made available. It is the hope of all that technical progress will be delayed as little as possible by the war.

* Calco Chemical Div., American Cyanamid Co.

Dyes for specific plastics

Dyestuffs are best incorporated into plastics by using a mutual solvent, or by using the plastic as a solid solvent. It is, therefore, practical to discuss the availability of dyes by classifying them with respect to their solubility characteristics in alcohols, hydrocarbons, mixed solvents and water, or to their insolubility.

Alcohol soluble dyes

There are available reasonable supplies of oranges and yellows of good fastness to light. The gloss blacks based on aniline (nigrosines) are available for the current needs of established business. Most of the other shade dyes of good fastness are limited. Basic dye reds (except fuchsine, color index 677) are being rationed as are some blues, but the other shade dyes are available in reasonable volume. Specialty dyes are likely to be scarce.

Alcohol soluble dyes are used in plastics of aniline aldehyde, cellulosic esters and ethers, certain natural resins and phenolic aldehydes.

Hydrocarbon soluble dyes

Aromatic hydrocarbons.—Reds, oranges and yellows are in reasonably good supply. Greens, blues, browns and blacks are limited. Bright violets and bright reddish blues, scarce.

Petroleum hydrocarbons.—Reds, oranges and yellows are available. Dyes for all other shades are limited or scarce.

Hydrocarbon soluble dyes are used in the following plastics: Acrylates, asphalts, coumarons, cellulose esters and ethers, cold molded organics, ethylene and butadiene elastomers, lignins, certain natural resins, modified rosins, organic polysulfides, rubbers, styrenes and vinyls.

Dyes for mixed solvents and water soluble binders

These are too numerous and varied to permit detailed review. In general, it can be assumed that all are limited in supply. However, it is in these solvents that substitutes are most easily provided, although each application is necessarily a separate study.

This group of dyes is used in plastics with the following types of binders: Alkyd, casein, cellulosic esters and ethers, cold molded inorganic, certain natural resins, proteins and polyamides, triazine aldehyde, urea-formaldehyde, starches and water soluble gums.

Insoluble coloring materials (used in all types of plastics)

Organic pigments, toners.—The reds based on metanitroparatoluidine, paranitraline (Para Reds), chlornitraniline and similar intermediates are being rationed. Vat pigments (anthraquinone derivatives) are limited in supply. Acetoaceticaryl amide yellows (Hansa) are also restricted.

Lakes (heavy metal salts of dyes)

The supply of certain lakes is restricted both by the limited availability of some dyes and of aluminum, lead and some other metals. Barium and calcium lakes are easier, except those made on aluminum hydrate bases. The phosphotungstate and phosphomolybdate lakes are also limited in supply, particularly the red and blue coloring products.

Inorganic pigments

Chrome oranges, yellows and green are limited. Cadmium reds are available only in relatively small quantities. Although tremendous quantities of ultramarine blues are being made, demands are so great that rationing is in practice and no new business is being written. Demands for steel and other chemicals have made iron blues and cobalt blues somewhat tight and 1942 quotas probably will be reduced as compared to 1941 deliveries. Domestic sources for siennas, umbers and similar earth pigments have been developed and are obtainable in reasonable volume. All white pigments such as titanium, zinc antimony and lead whites are extremely short and are being rationed.

Fluorescent and phosphorescent materials

The general public tends to confuse fluorescent and phosphorescent effects, but the technician must differentiate between them. Fluorescent materials are visible in the dark only when under ultraviolet radiation, whereas phosphorescent materials continue to glow in the dark for some time after the short-wave radiation has been removed.

Fluorescent dyes are useful where ultraviolet sources are installed. For most homes or general blackout uses, phosphorescent effects are more adaptable. It should be noted also that fluorescence fades as the dye fades.

All fluorescent dyes are short, and in general no new business can be handled. The same is true of most of the phosphorescent inorganic products.

Use of color blends

The plastic colorists can often substitute blends of available dyes to extend or entirely substitute for those of which the supply is limited. The blends must be made with considerable judgment, however, or the shades obtained may prove to be quite dull and unattractive. Colorists with limited experience may find the data in Table I a useful general guide.

TABLE I.—COLOR BLENDING SUGGESTIONS FOR EMERGENCY REPLACEMENTS

To replace	*Blend*
Bluish red	Scarlet with red purple (dull)
Scarlet	Bluish red and orange
Orange	Scarlet and red yellow
Yellow	Blends yield yellow browns
Green	Blue and yellow
Blue	Green with purple or blue red (dull)
Violet (purple)	Red blue and bluish red (dull)
Red browns	Orange and scarlet with black blue or green
Yellow browns	Yellow and black; orange and blue
Green browns	Orange and green; orange and blue

In nearly every application, the blended shades will be duller than the unblended coloring. Other properties may vary also, notably the fastness to fading, heat and bleeding. Certain reds, blues and bright violets will be difficult to approach with blends. It is rarely possible to match a yellow without using a yellow, as mixtures of orange and greens usually yield yellow browns. The suggestions given are definitely emergency recourses for the most part.

The plastics chemists who try to make phenolic type resins without using phenol are in no worse position than their dyestuff confreres. If the latter try to substitute cresol, resorcinol, alpha or beta naphthol, they get browns, oranges and scarlets instead of yellows. Any dye substitute offered should, therefore, be thoroughly tried out. It may be necessary to use wet processing methods instead of dry, or dry rolling, instead of making doughs in order to incorporate the substitute dye. Fortunately everyone realizes ingenuity, patience and cooperation are the needs of the day in our country at war.

Somebody is doing

"Everybody talks about the weather
But nobody does anything about it."

CHARLES DUDLEY WARNER

That was said before the remarkable radiosonde was perfected . . . the radiosonde that rises far into the stratosphere . . . picking up the glint in Dame Nature's weather eye . . . and instantly reporting each of her whims and moods to a weather station receiver below.

Produced by the Washington Institute of Technology, this instrument now makes possible the highly accurate weather forecasts so essential for military and aeronautical planning.

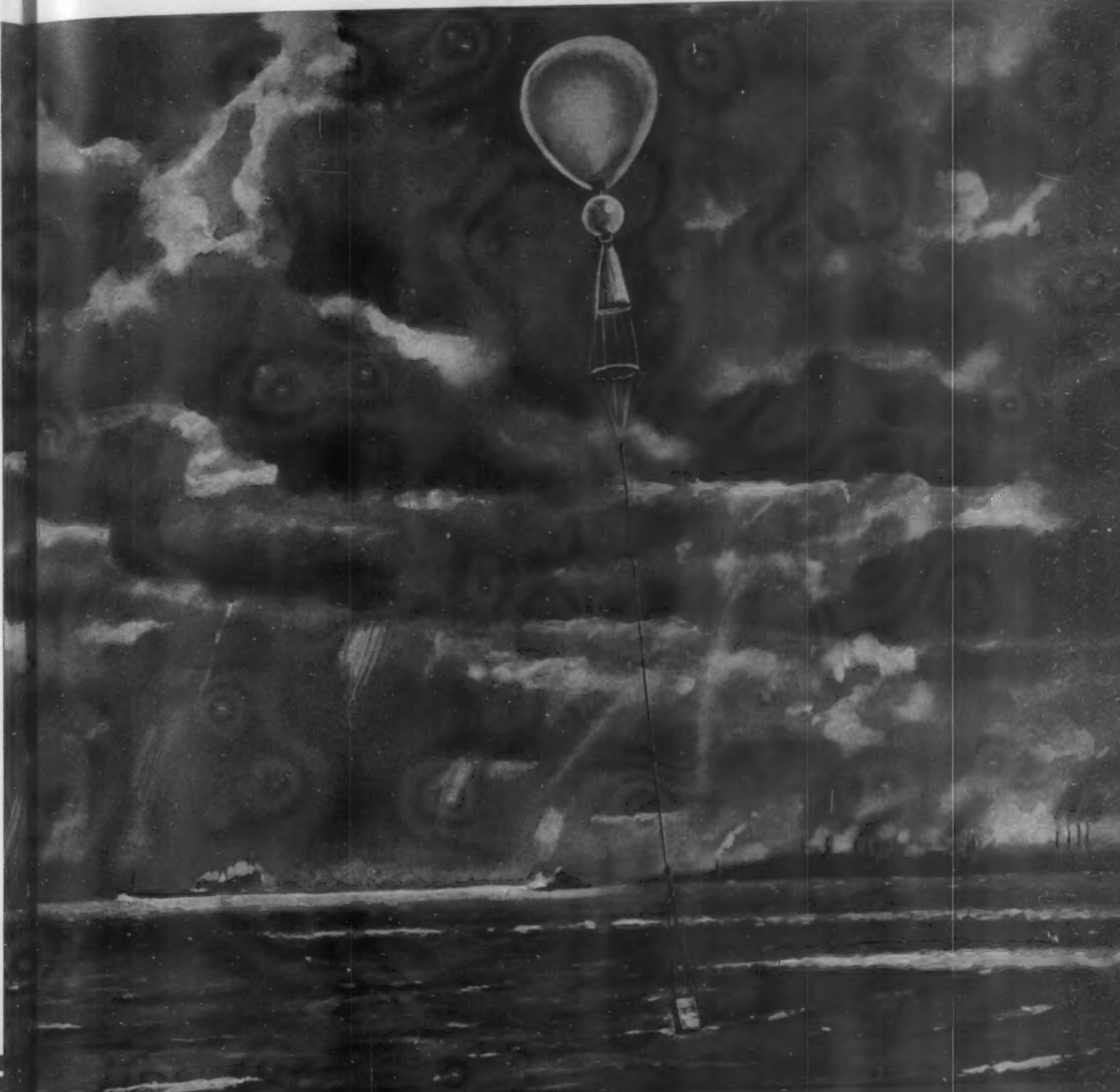
Basically, the radiosonde is a small radio sending set. The device is attached to helium-inflated balloons and released from pre-selected ground points. As the balloons rise, the radiosonde begins a continuous broadcast, signalling the prevailing temperatures, barometric pressures, and humidity readings.

These signals automatically are picked up by ground headquarters. The balloon ascends many miles into the stratosphere where it bursts, and the instrument parachutes slowly earthward, while maintaining an uninterrupted broadcast.

Molded Plaskon is used for the delicate but sturdy framework within the radiosonde. The light weight of Plaskon permits the gaining of higher altitudes, functional improvements, and the attainment of important new accuracy standards in operation.

The radiosonde is another example of how Plaskon is being used for today's wartime needs. Although these requirements have considerably reduced the amount of Plaskon available for civilian purposes, we shall be glad to help plan now for your future use of this important urea-formaldehyde plastic. Plaskon Company, Inc., 2121 Sylvan Avenue, Toledo, Ohio. Canadian Agent: Canadian Industries, Limited, Montreal, P. Q.

g something about it!

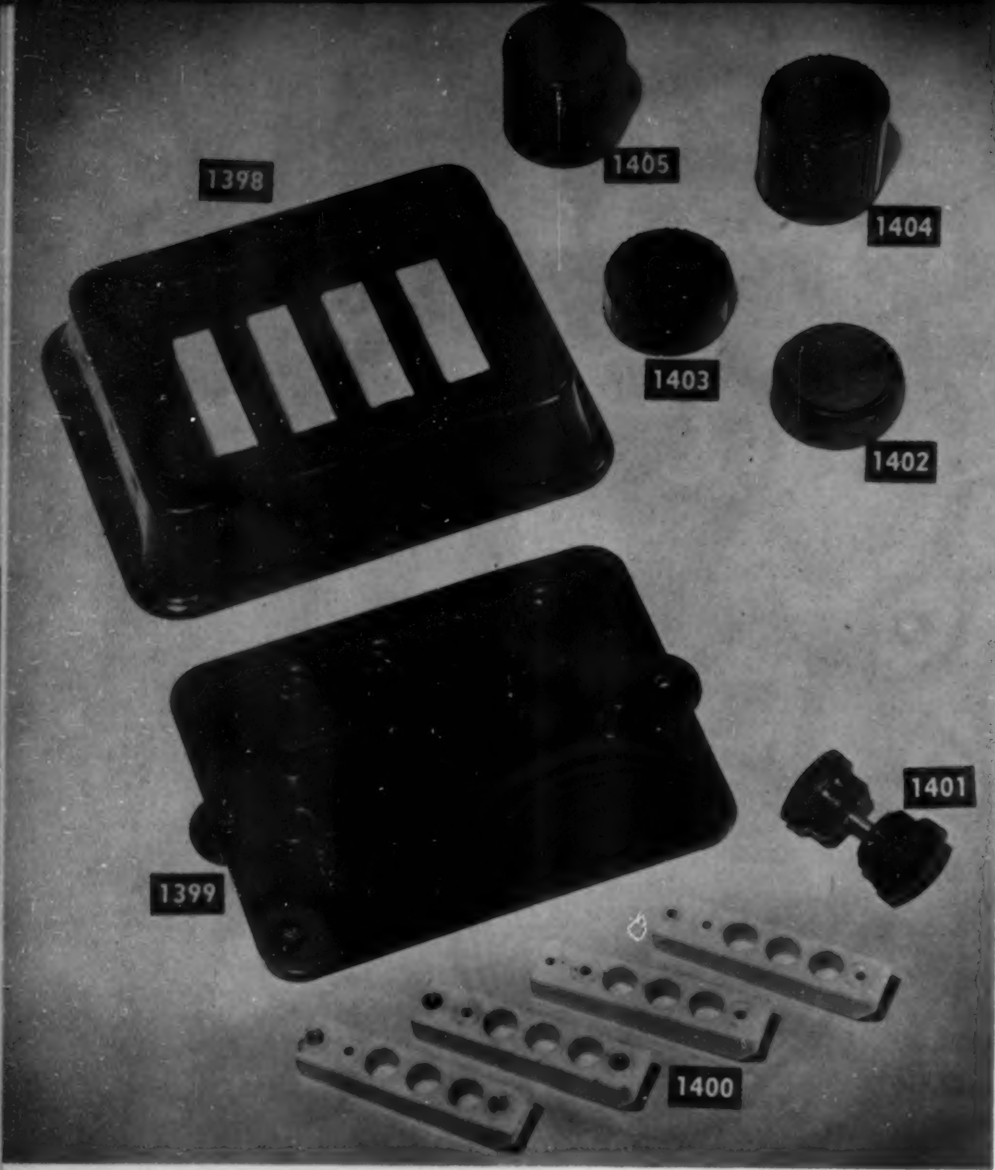


Above: The radiosonde rising into e air over a large body of water, ust release from a weather station.

Left: Photo of radiosonde parts olded of Plaskon, chosen for this b because of its light weight . . . rength . . . and aid to radiosonde perating efficiency.

PLASKON

MOLDED COLOR



Reprints of all stock mold pages which have been published to date, with a complete index of suppliers, are available in book form to Stock Mold Service subscribers

All molders are invited to submit samples from stock molds to appear on this feature page as space permits

Stock molds

SHEET ONE HUNDRED-SEVENTEEN

A control housing with four keys, terminal knobs, bottle caps meet a variety of needs. Available from stock molds without mold cost—subject to restrictions on raw material supplies. Address Modern Plastics, Chanin Building, New York, giving item and sheet numbers

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1398. Control housing top section. 4 11/16 in. long by 3 11/16 in. wide at base. Top measures 3 15/16 in. by 2 15/16 in. 4 rectangular slats 2 in. long by 7/16 in. wide. 2 mounting posts molded on inside with 1/8 in. screw openings

1399. Control housing base 4 5/8 in. by 3 1/4 in. 1/16 in. high raised rib 2 3/4 in. long; 2 13/16 in. long raised area and 4/12 in. high posts. Four pairs 3/16 in. indentations on bottom for keys

1400. 4 keys for control housing. 3 wells 1/4 in. diameter. Each key numbered on bottom for easy identification for proper placement

1401. Two terminal knobs 3/4 in. diameter; decorated edge; 7/16 in. long; 1/8 in. diameter screw hole

1402. Threaded, decorated cap; 1 3/16 in. diameter; 7/16 in. deep; lined top has rough surface, pulp and vinyl waxed liner

1403. Cap with decorated wall; threaded at top and lined. 1 1/8 in. deep. 1 3/16 in. diameter. Pulp and vinyl resin waxed liner

1404. Decorated cap, threaded at top, lined. 1 1/8 in. deep; 1 3/16 in. overall diameter

1405. Decorative cap threaded, finely ridged. 1 3/16 in. diameter, threaded at top. 1 1/8 in. deep

DR. GORDON M. KLINE, Technical Editor

Process anneals of alloy mold steels

by E. K. SPRING and J. K. DESMOND*

EXPERIMENTAL work dealing exclusively with plain carbon mold steel, which was reported in MODERN PLASTICS for June 1941, led to similar work on alloy mold steel. Some departures from the work described in the previous article have been found desirable, mainly because of differences in composition. Comparisons are made of the behavior of the two steels.

Makers of hobbed molds have for some time used both plain carbon steel and alloy steel, one of the common alloys being a nickel-chrome steel approximating SAE 3110 with carbon held below .10. It is this alloy on which certain information has been developed which will be of interest to mold makers.

As cited in the previous article, *process annealing* as defined by the American Society for Testing Materials is "heating to a temperature below, or close to, the lower limit of the critical temperature range followed by cooling as desired." We hope to show that not only an annealing temperature in excess of the critical range, such as 1535 deg. F., allows maximum continuance of hobbing, but also that short time, low temperature process anneals in the neighborhood of 1250 deg. F. are effective, and may, for various practical reasons, be more satisfactory than the higher temperature of 1535 deg. F. The annealing method generally recommended and followed is to pack a partially sunk die in some protective substance, heat within the range 1500 deg. F. to 1600 deg. F. and cool slowly in the furnace.

The material tested in the present work was a low-carbon nickel-chrome iron melted in the electric furnace, and marketed under the name *Disston Plastalloy* of the following analysis: C .08; Mn .43; Si .13; Ni 1.30; Cr .56. Rectangular blocks 2 in. by 2 in. by 8 in., cut from annealed bars 8 in. wide by 2 in. thick, were subjected to 3 hobbings interspersed by an anneal between hobbings to determine the effect of different annealing temperatures on the continued hobbing qualities of the blocks. The size hob, pressures and procedures were the same as described in our previous article on *Plastiron*, but it was found that after the first hobbing it was necessary to use oil on the hob to permit withdrawal.

Table I shows the depth in inches the hob sank after each hobbing operation into blocks annealed from different temperatures.

The first hobbing can properly be compared with the first

* Chief Metallurgist and Sales Metallurgist, Henry Disston & Sons, Inc.

TABLE I.—DEPTHS HOBBED IN PLASTALLOY BLOCKS AT VARIOUS PRESSURES. HARDNESS OF BLOCKS AT FIRST HOBBING WAS 31-33 G SCALE ROCKWELL

Block Annealed	Pressure Tons/Sq. In.	Depth of Hobbing in Inches: 1st Hobbing	2nd Hobbing	3rd Hobbing	Total 2nd and 3rd Hobbings	Total 3 Hobbings
1100° F. for 2 hrs.; air cooled	200	.142	.093	.060	.153	.295
	300	.247	.187	.076	.263	.510
	400	.447	.285	.163	.448	.795
1200° F. for 2 hrs.; air cooled	200	.137	.117	.068	.185	.322
	300	.245	.205	.085	.290	.535
	400	.422	.270	.190	.468	.890
1300° F. for 2 hrs.; air cooled	200	.140	.117	.068	.185	.325
	300	.240	.220	.095	.315	.555
	400	.454	.285	.189	.474	.928
1400° F. for 2 hrs.; air cooled	200	.124	.128	.078	.206	.330
	300	.232	.224	.109	.333	.565
	400	.453	.302	.200	.502	.955
1500° F. for 2 hrs.; air cooled	200	.138	.132	.080	.212	.350
	300	.246	.225	.109	.334	.580
	400	.422	.330	.247	.578	1.000
1600° F. for 2 hrs.; furnace cooled	200	.139	.133	.080	.213	.352
	300	.235	.230	.115	.345	.580
	400	.450	.334	.260	.594	1.044

Table II.—Effect of Annealing Temperature on Volume of Material Displaced in Hobbing Plastalloy

Pressure Tons/Sq. In.	Average Volume in Cubic Inches Displaced by Three Hobbings of Table I when Annealed from: 1100° F.	1200° F.	1300° F.	1400° F.	1500° F.	1600° F.
200	.00522	.00575	.00580	.00592	.00629	.00636
300	.00957	.01012	.01062	.01082	.01112	.01112
400	.01630	.01837	.01947	.02106	.02140	.02265

Table III.—Effect of Annealing Temperature on Hobbing Quality of Plastalloy (Anneal at 1600° F. = 100%)

Pressure Tons/Sq. In.	Average Percentage Hobbing when Annealed from: 1100° F.	1200° F.	1300° F.	1400° F.	1500° F.	1600° F.
200	82	90.5	91.2	93	98.7	100
300	86	91.2	95.5	97.5	100	100
400	72	81	86	93	94	100
Average for 3 pressures	80	87.6	90.9	94.5	97.6	100

Table IV.—Comparative Hobbing Qualities of Alloy and Iron Blocks

	Alloy				Iron	
Pressure Tons/Sq. In.	Ave. Depth of First Hobbing, In.	Percent of Iron	Ave. Depth of 2nd and 3rd Hobbings Combined, In.	Percent of Iron	Ave. Depth of First Hobbing, In.	Ave. Depth of 2nd and 3rd Hobbings Combined, In.
200	.136	84	.192	86	.162	.223
300	.241	75.3	.313	60.9	.320	.514
400	.441	74	.511	59.2	.595	.863
Average Percentage		77.7		68.7		

hobbing of the *Plastiron* previously reported. Such a comparison for the second and third hobbings, when it became expedient to use oil on the hob, would probably be less accurate. It appears that alloy hobbing iron has a greater tendency to hug the hob than the plain carbon and the need for lubricant on the alloy is more pronounced.

Table II presents the volume in cubic inches displaced by the average depth of the three truncated conical hobbings for each pressure given in Table I.

In Table III the percentage of hobbing quality resulting from the various anneals is given based on the volumes displaced. It is to be noted that the average hobbing resulting from annealing at 1200 deg. F. as compared with that resulting from 1600 deg. F. anneal is 87.6 percent. As previously found when working with plain carbon hobbing iron, low temperature process anneals permit virtually as much continued hobbing as when resort is had to anneals from above the critical.

Table IV shows the comparative response of initial hobbing of alloy compared with plain iron. The data on iron are taken from the previous report. The values represent averages of 6 sinkings in the alloy and 18 sinkings in the iron at each condition given. From Table IV it appears that the alloy sinks 77.7 percent as much as iron on the first hobbing and to but 68.7 percent for the second and third hobbings. The percentages compared are based on depths of hobbing, not on volumes displaced.

Table V.—Effect of Time of Application of Load on Displacement of Alloy in Hobbing

Load of 300 Tons Applied in	Depth of Hobbing, In.
15 sec.	.258
30 sec.	.241[a]
$1^1/_2$ min.	.250
$2^1/_2$ min.	.255
5 min.	.248
10 min.	.263

[a] Average from Table I.

Table VI. Effect of Annealing Temperature on Hardness of Alloy under Cavities Hobbed at Various Pressures

	Rockwell G Scale[a] Readings at Approximately $^1/_8$-In. Intervals from Bottom of Cavity towards Base			
Hobbing Pressure Tons/Sq. In.	Unannealed	Annealed at 1200° F., Air Cooled	Annealed at 1500° F., Air Cooled	Annealed at 1600° F., Furnace Cooled
200	60	24	24	31–33
	62	26 (Crescent)	21 (Crescent)	31–33
	58	37	34	31–33
	56	36	33	31–33
	45	33	33	31–33
	38	33	..	31–33
	33	..	..	31–33
300	61	29	28	31–33
	63	26	30	31–33
	47	22 (Crescent)	21 (Crescent)	31–33
	40	40	36	31–33
	38	38	33	31–33
	35	35	..	31–33
	33	..	..	31–33
400	78	26	28	31–33
	65	28	26	31–33
	60	25 (Crescent)	22 (Crescent)	31–33
	55	41	36	31–33
	45	39	34	31–33
	39	35	..	31–33
	35	..	..	31–33

[a] $^1/_{16}$-in. ball, 150 kg. load.

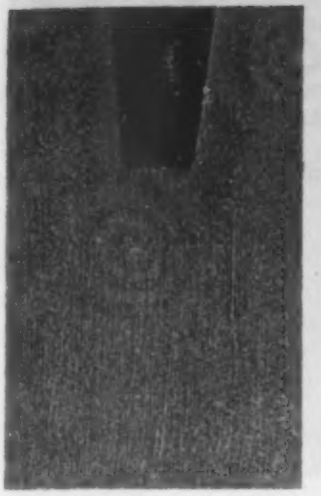


Fig. 1

Fig. 2

1—Shows grain growth under the cavity in a nickel-chromium block improperly annealed under the Ac_3 critical point. 2—Represents the absence of grain growth in a properly prepared block. After hobbing, the nickel-chromium block has received an anneal above the Ac_3 point

A study of the rate of application of the load as it affected the displacement in hobbing was made. The variation in depth hobbed appears not to vary beyond the limits of error when the total time to apply a load of 300 tons falls within the time limits of 15 seconds and 10 minutes (see Table V).

A study of the hardness of the hobbed steel both before and after annealing was made to assist in choosing the proper annealing temperature for various hobbing pressures. The experimental results are presented in Table VI.

Hobbing has developed a hardness figure of 60 to 78 G scale immediately under the cavity compared with 31 to 33 G scale hardness originally. An anneal of 1200 deg. F. removed virtually all of the strains taken out by the more commonly used 1500 deg. F. Between the crescents and the cavity the hardness is actually below that of the fully annealed blocks. The hardness of the unannealed alloy blocks is approximately that of unannealed plain carbon mold steel.

Micro-examination of the metal below the cavity of blocks of alloy and iron annealed at 1200 deg. F. revealed the following comparison of grain sizes in similar locations. The SAE Grain Size Chart was used to give a numerical comparison of grain size. It is to be remembered that on this chart the smaller the grain size number the larger the grain.

Iron		Alloy	
Location Examined	Grain Size	Location Examined	Grain Size
3/32 in. under cavity	2 1/2	3/32 in. under cavity	2 1/2
1/4 in. under cavity	4	1/4 in. under cavity	4 1/2
In crescent	1–1 1/2	In crescent	2–2 1/2
Matrix	3	Matrix	7

From this it is seen that grain growth is less in the alloy iron than in the plain iron. Annealing from various temperatures revealed that when annealing is done from below 1560 deg. F., a crescent of enlarged grain existed at some distance from the cavity. Annealing at or above 1560 deg. F. resulted in no crescent of large grain.

Measurements of compressive strength of the two steels, alloy and iron, revealed a compressive yield point for the alloy of 65,000 lbs. per sq. in. with but 45,000 lbs. per sq. in. for the iron, after treatments such as dies prepared from these blocks would receive. The conditions produced by these treatments permit us to measure the relative stiffness of the core material as it would be in carburized heat-treated dies. The greater resistance of the alloy indicates that such material is better suited for applications where high unit stresses are to be met in service, a better backing up of the carburized cases being afforded by the alloy after the usual treatments.

The temperature at which the hobbing is performed was found within limits tried to have little effect on the depths to which the hob sank. In developing the facts warranting this statement sample blocks were treated as indicated below and hobbed immediately after they were removed from the cooling or heating medium.

Treatment Prior to Hobbing	Depth of Penetration
Packed in dry ice one hour	.220 in.
Packed in ice one hour	.243 in.
Room temperature	.241 in.
Heated in boiling water to 212 deg. F.	.245 in.
Heated to 450 deg. F.	.265 in.

(Please turn to page 96)

Fig. 3

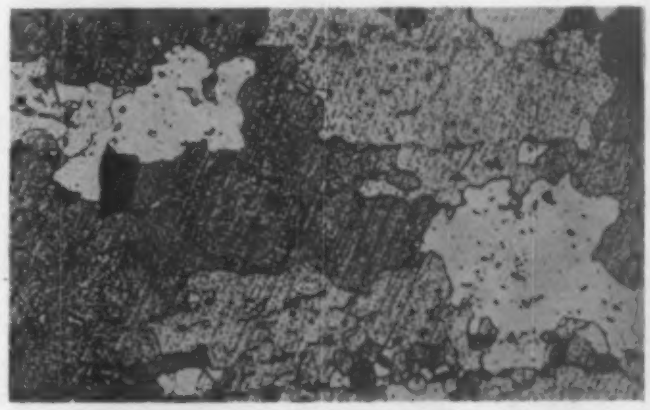
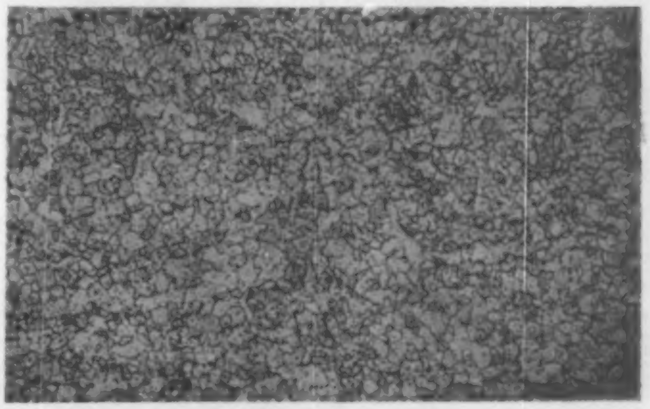


Fig. 4



3—Demonstrates the grain size SAE No. 2 1/2 developed within the crescent after an anneal at 1250 deg. F. for two hours. The stress lines are also visible. 4—Displays the grain size SAE No. 7 in the same location as that which produced Fig. 3, but after a proper anneal above the Ac_3 point

Heavy section injection molding

by A. R. MORSE*

THIS article reviews some of the current practices in heavy section molding. The information contained in it may also be of general aid in molding difficult pieces.

Care in drying molded powders

Moisture is one of the most frequent sources of bubbles or seeds in molded pieces. Inadequate drying is not the only cause of this defect. It has been found that warm material from a drier is apt to pick up moisture as it cools. Accordingly, some general practices to avoid this difficulty are listed.

1. Ventilation of drying cabinets by providing a stack to remove condensates and moisture fumes is recommended. Forced ventilation—blowing air over heated elements—is often used. This cuts down time required for moisture removal, as compared with the closed cabinet type of drier.

2. Use of infrared or heat lamps mounted on brackets and directed at the machine material hopper is suggested. This prevents hygroscopic cooling of material, or sweating, which sometimes appears to take place when warm material is placed in the cool hopper.

3. A cloth or screen cover is sometimes made for the hopper to prevent condensation on the hopper lid, which occasionally occurs where warm material is placed in the hopper. This allows residual moisture to escape, as it has been observed that when trays are poured into the feed hopper the agitation releases some additional moisture. It also prevents contamination from the dust which is noticed when the hopper cover is left off—a condition observed especially in reground fines.

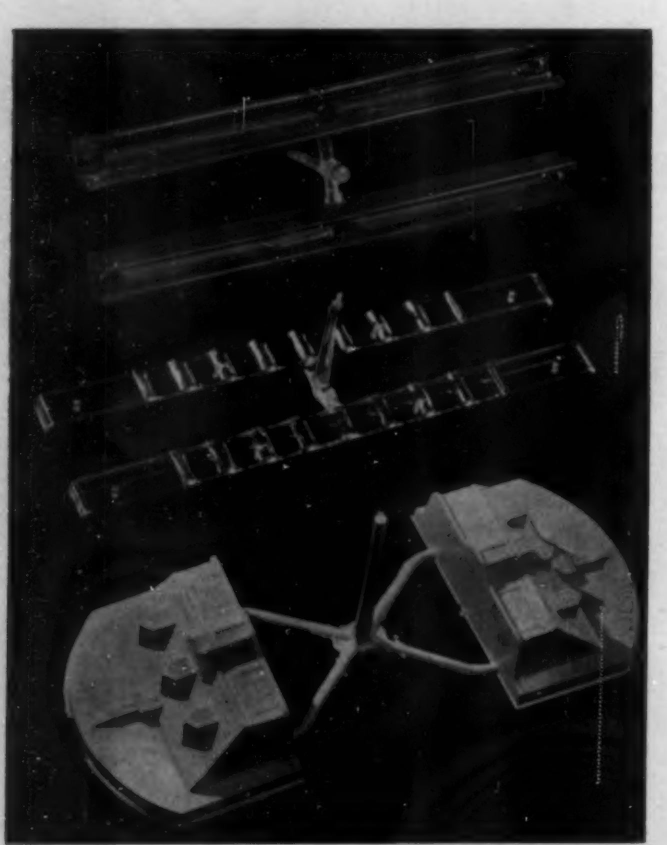
Sifting of material to remove fines is advisable when molding difficult work. This prevents segregation of material in the hopper, presents an even grained material flow to the heater surfaces and prevents differential or non-uniform fusion or melting which can drag streaks into the work. Fines, therefore, sometimes seem to cause streaks. They dull finishes, due to their affinity for dust; "burn" readily; and scour under the plunger. Fines also absorb atmospheric moisture rapidly and so are a potential source of bubbles.

Use of heated molds

To prevent shrinkage, sagging and the formation of bubbles or seeds, large section molds are often heated. Actual temperature appears to run from 145 deg. to 170 deg. F., depending on material, cycle and piece being molded. Some general procedures in regard to mold heating are listed below.

1. An indicating pyrometer is often used to show actual mold temperatures. This instrument is sometimes equipped with a three- or four-way switch, with several thermocouples mounted in wells directly in the mold. The pyrometer is easily mounted on the horseshoe or on the stationary die plate of the molding press by means of a bracket and tapped holes. A suitable indicating pyrometer may be purchased

* Reed-Prentice Corp.



These sprues produced by injection molding indicate advances in technique. New methods of mold design, gating and increased capacity equipment have made it possible to mold such large sections with satisfactory results.

for around $50. A four-pole switch costs around $15. Couples and lead wires cost around $25. A rough estimate of an accurate pyrometer installation cost complete is, therefore, around $150, depending on equipment chosen.

Location of temperature wells in the mold is an important factor and should be done with a view to the requirements of each cavity.

2. New presses may be equipped with valves in the standard water circulation attachment so that closed-circuit die heating may be used. Valves are provided so that flow to the dies may be regulated from the operator's side of the machine, regardless of whether hot or cold water is used. This ready adjustment encourages closer operator attention to mold temperature and should increase product quality.

3. Water for the die heating is heated in various kinds of commercial water heaters, gas or oil fired. Thermostatic controls are being used to maintain any desired temperature in the die water heater, and are giving encouraging results. During the past year it has become increasingly apparent that close regulation of die temperature is essential to a high percentage output of quality work. This is equally true whether hot or cold water is used in the dies.

4. In general it may be observed that the most successful heavy sections are molded in heated dies, where the die temperature is closely controlled by a thermostat, and where a pyrometer is used to show actual mold temperatures.

Nozzle size

1. Nozzles are normally stocked in $^1/_8$-in. and $^5/_{32}$-in. sizes. For large shots, bigger nozzles openings have come into general use. For heavy molding requirements, special nozzle openings of any diameter up to $^3/_8$ in. may be obtained.

2. Alteration of nozzles in molding plants is not recommended, since the required special facilities for reaming, hardening and plating are not generally available. The nozzle seat may be injured during inexpert alterations. This furnishes a lodging place for material, as well as causing stuck nozzles. When nozzle alterations are made at the factory, each piece is thoroughly inspected to insure proper seating and satisfactory performance.

Pressures

1. For molding large shots, maximum pressure is often *not* required. This statement is borne out by performance records in several shops handling large sections. In many instances 500 lb. plunger pressure is sufficient to shoot the largest shot. A slight variation in pressure produces considerable change in the appearance of the molded piece. It has been observed that, in general, changes in pressure when working out a job are made with too great an increment.

2. One may readily observe that adjustments of only one or two tenths of a second on the setting of the timer produce a considerable change in mold filling. As a general rule, once the pressure valve is set, it is recommended that if the mold does not fill, or flashes, minor adjustments may be better made in the setting of the timer target than in changing the plunger pressure control valve.

3. For special cases where it is desired to regulate the speed of the plunger independently of the pressure, presses may be readily equipped with a plunger speed control valve. It has shown excellent results where difficult shots had to be made. Generally, a very slight adjustment of the plunger speed control valve produces a marked benefit in the piece being molded. This is especially true where the mold shows peculiar filling characteristics.

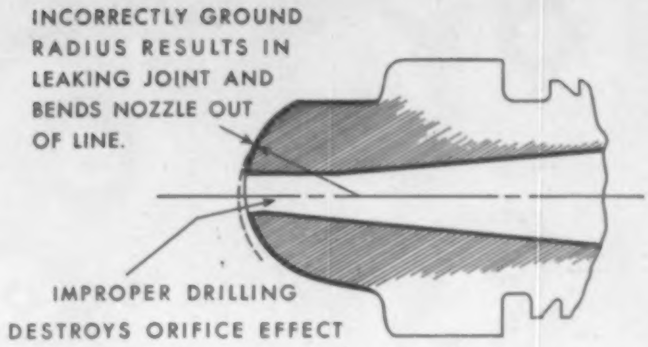


Fig. 1

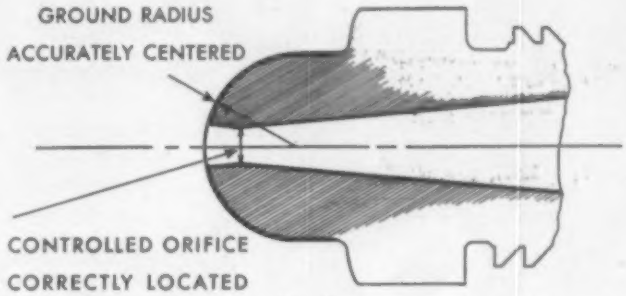


Fig. 2

***1**—Damage which may result from unskilled alterations. Improper heat treatment destroys hard nose and chrome plating. **2**—Correct factory shaped injection machine nozzle. Proper heat treatment produces hard nose, non-brittle threads. Heavy lines show chrome plated surfaces*

4. Where extremely high pressures are required, it is found that a high-pressure heater accessory gives excellent results. This high-pressure adapter reduces the capacity of the machine somewhat, and is not necessarily recommended for average heavy section molding. It is generally advisable that for best results a heater be purchased especially assembled at the factory for the higher pressures if these are required.

Temperature

1. In general, depending on the molding material, a range of from 350 to 450 deg. F. includes most cases of heavy section molding. Very few generalizations in regard to temperature can be made on the basis of current practices, because conditions vary so materially from plant to plant. Marks, bubbles and flaking are often caused by incorrect heater temperature, but few rules of temperature can be given to eliminate them other than those furnished by the material supplier in his specifications.

2. It may be cautioned that changes made in temperature are definitely interlocked with the adjustment of the pressure on the plunger, the timer setting and the cycle. An increase in temperature is compensated for by decreasing the plunger pressure and/or shortening the timer cycle. A decrease in temperature is compensated for by increasing the plunger pressure and/or lengthening the timer cycle.

Timing cycles

The automatic cycle setting varies with working conditions. Many 8-oz. shots of heavy sections require maximum setting of all timer clocks, or a very long (*Please turn to page 104*)

Mineralite—a filler for plastics

by SAMUEL WEIN

MINERALITE is a material which has been used successfully in paints, rubber compounds and cleansers during the past year. It has four principal characteristics—fineness of mesh, high heat resistance, low moisture absorption and high dielectric strength. In view of the present plastics raw materials shortage, mineralite may play an important rôle as a filler for plastics providing the prospective user is willing to carry on his own experiments and tests and take advantage of the results in practicable applications.

Mineralite is an aluminum silicate mined in Kershaw, South Carolina. Commercially it is available in the form of a very fine white powder of uniformly graduated particle size from −325 to a theoretical −10,000 mesh. The following is a schedule of readings made from laboratory sedimentation apparatus used to determine the exact percentage distribution of particle sizes in 3-X mineralite. Note the uniform graduation of this material from less than 325 (44 microns) to the theoretical 12,500 mesh (1 micron). The first particle had a radius of 39.9 microns.

Meas. scale	*Microns*	*Percent*	
.15 mm.	39.0 to 28.6	.67	
.35 mm.	28.6 to 24.0	1.57	−325 mesh
.50 mm.	24.0 to 19.8	2.24	+625 "
1.00 mm.	19.8 to 18.7	4.50	
.50 mm.	18.7 to 17.5	2.24	
.50 mm.	17.5 to 16.0	2.24	
1.00 mm.	16.0 to 15.3	4.50	
1.00 mm.	15.3 to 13.9	4.50	−625 "
.50 mm.	13.9 to 13.0	2.24	+1250 "
.50 mm.	13.0 to 12.6	2.24	
1.00 mm.	12.6 to 11.7	4.50	
1.00 mm.	11.7 to 11.3	4.50	
1.00 mm.	11.3 to 9.7	4.50	
.50 mm.	9.7 to 9.3	2.24	
.50 mm.	9.3 to 9.0	2.24	−1250 "
2.00 mm.	9.0 to 7.6	9.00	+2500 "
2.00 mm.	7.6 to 6.5	9.00	
2.00 mm.	6.5 to 5.2	9.00	
3.50 mm.	5.2 to 3.5	15.74	
.70 mm.	3.5 to 3.0	3.14	−2500 "
1.80 mm.	3.0 to 2.0	8.00	+10,000"
.30 mm.	2.0 to 0.0	1.20	
22.30	Final reading	100.00	

Theoretical Equivalents

44 microns	=	325 mesh	
20 "	=	625	"
10 "	=	1,250	"
5 "	=	2,500	"
$2^1/_2$ "	=	5,000	"
1 "	=	12,500	"

A well known mineralogist reports mineralite as marketed to contain:

Element	*Percent*
Silica	51.0
Alumina	35.207
Potash	7.77
Iron oxide	.95
Titanium oxide	.20
Sulfur	.003
Lime	1.23
Phosphorus	.008
Magnesia	.63
Loss on ignition	3.0

Its melting point is 2700 deg. F. Direct flames applied to it will not cause it to char or burn. It is entirely water insoluble, giving rise to moldings or castings with very low water absorption if sufficient quantities of mineralite are used in a batch. It is tasteless and odorless. Measurements indicate that it has a low power loss.

In order to ascertain the effect of acids on mineralite, it was treated with hydrochloric, sulfuric and phosphoric acids, hot and cold. There were no signs of solution, except with hydrochloric acid, which was slightly discolored to a pale yellow. Likewise it was not affected by alkalis or organic solvents.

The specific gravity of mineralite is 2.75 as determined by the "apparent loss of weight in water" method, or, 2.62 as determined by the method described by Gardner.[1] There are 20.7 pounds per solid gallon; loose bulking value is 15.5 pounds per cubic foot. When mineralite is compounded into molding compositions, the specific gravity is in the range of 1.45 to 2.12, depending on the resin-filler ratio. Mineralite-filled phenol-aldehyde plastics in present commercial use have a specific gravity of 1.59 to 2.09.

Mineralite has a decided affinity for dyes, and is readily miscible with lakes and pigments, yielding plastic compounds of rich pastel and solid colors. Because of its white natural color, mineralite has a decided advantage in that light-colored resin coatings are possible.

Mineralite has an "inherent slip" which is an important factor in lubrication during molding. Its use permits a reduction in the amount of calcium stearate commonly used as a lubricant. Further, there is a tendency for the resins to stick to the compound rolls when a batch is being mixed. Such sticking causes uneven distribution of the filler with consequent increase in the number of rejects or even inferior appearance in the accepted piece. The use of mineralite in the mix reduces this tendency of the molded pieces to stick in the molds. The reduction in the amount of calcium stearate permits an increased speed of cure.

Where the impact strength and brittleness of a piece is not important, mineralite may be successfully used up to 75 percent. When these properties are of prime importance, incorporation of wood flour, cotton linters or any other similar fibrous filler up to 25 percent of mineralite used will increase the impact strength.

Typical experimental compositions containing mineralite are as follows:

Compression molding compounds

		Parts	
Mineralite	67	75	67–75
Wood-flour[2]	33	25	...
Phenolic resin	50	50	33–25

(*Please turn to page 96*)

[1] *Paints, Varnishes, Lacquers, Colors*, pp. 140–2, 4th edition.
[2] Cotton linters, etc., may be used in place of wood-flour.

Mold designed to trim sprues

by W. C. RENWICK*

IN designing an injection mold for a Venetian blind tassel, it was desired to provide means for trimming off the runners automatically as the mold opened. A method for doing this was outlined by I. Felton in the May 1941 issue of MODERN PLASTICS. However, in the design described here a new approach to the problem accomplishes the same result with a simpler construction.

Sketches have been prepared to show those elements which are essential to the sprue-trimming function of the mold. Certain parts have been omitted, such as a spring to return the ejector plate to position and stripper bolts to prevent the spring from pushing the plate out of position.

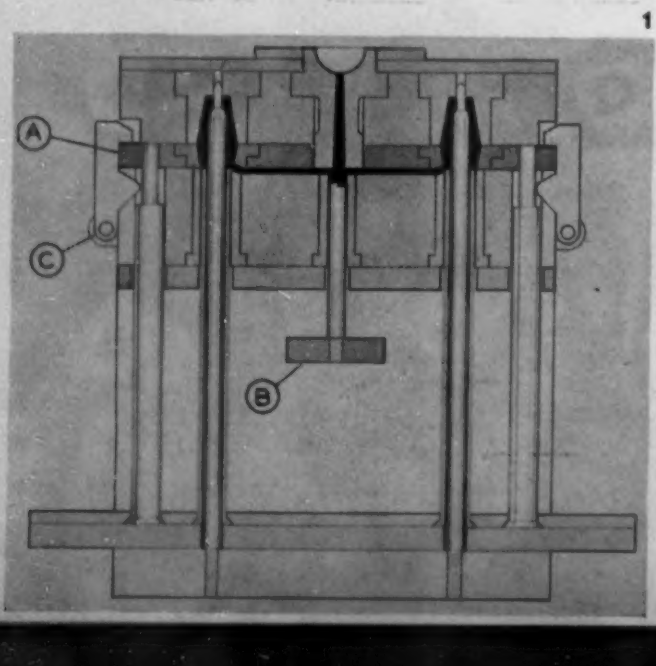
The conventional design called for stripper sleeves to free the piece from the case and the usual push-back pins to protect the sleeves. By addition of a "loose cavity plate" (A), a sprue ejector plate (B) and "plate locks" (C), the mold is converted, as shown in Fig. 1, to one which will automatically trim the sprues. The push-back pins are provided with shoulders to trip the plate locks. The ejector bars shown in Figs. 2 and 3 have been omitted from Fig. 1.

The opening phase of the molding cycle starts from the position indicated in Fig. 1 and continues to a point shown in Fig. 2 where the runners have just been cut by the action of the sleeves which have been stopped by the ejector bars. The shoulders on the push-back pins are at the point of tripping the plate locks which hold the loose cavity plate during the cutting operation. The loose cavity plate having been unlocked (Fig. 3), the mold continues to back away until the stripper plate pushes the sprue ejector plate, thus freeing the sprue for removal.

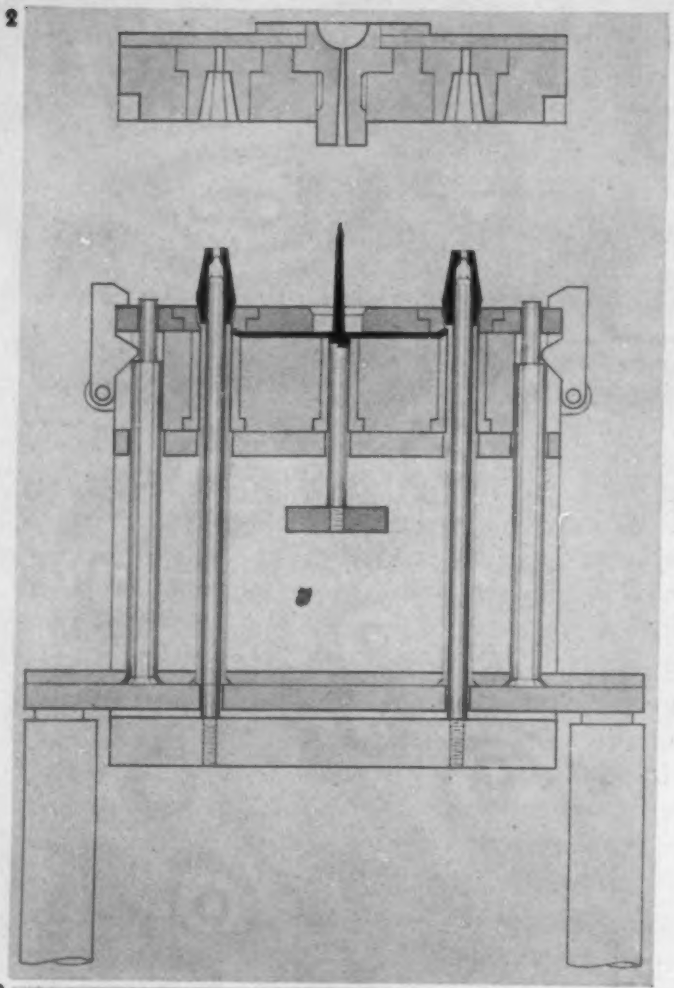
The tassel mold opens far enough for the operator to clean and lubricate the mold easily, and there are no stripper screws blocking access to the mold faces. The runners follow a simpler path to the piece, and so there is less chance for material flashing into cracks when wear has loosened the fit of sliding members.

* Plastics Industries Technical Institute.

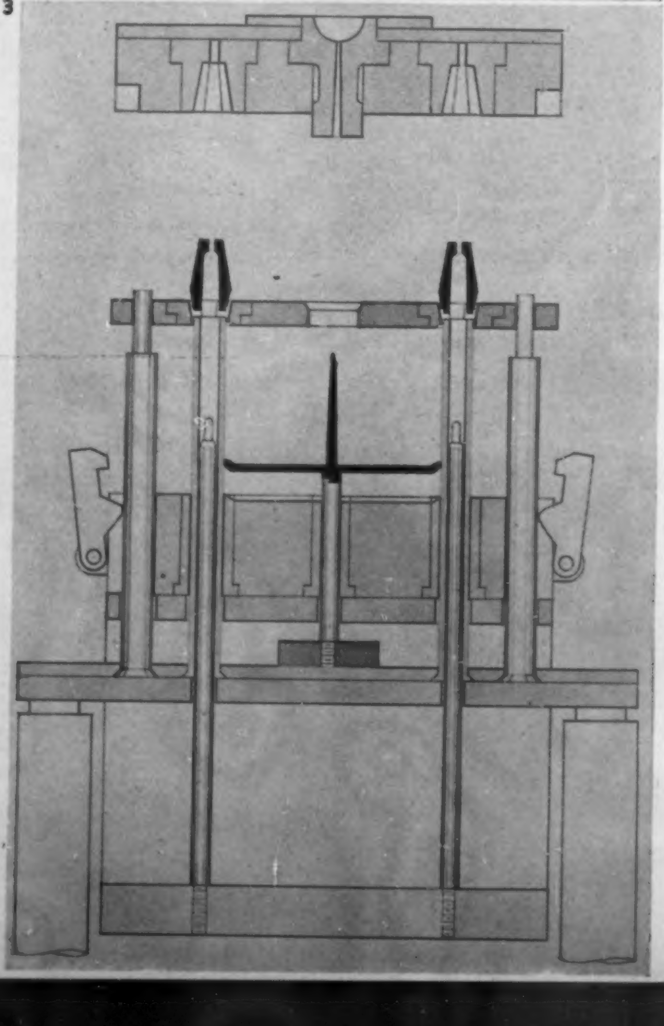
1



2



3



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Plastics digest

This digest includes each month the more important articles of interest to those who make or use plastics. Mail request for periodicals mentioned directly to individual publishers

General

INDUSTRIAL PROGRESS IN SYNTHETIC RUBBERLIKE POLYMERS. H. I. Cramer. Ind. Eng. Chem. *34*, 243-51 (Feb. 1942). The raw materials, commercial syntheses, applications and costs of the polymers of butadiene and its derivatives, polybutenes, alkylene polysulfides, and the plasticized polyvinyl chlorides are reviewed. As a result of relatively small-scale production, butadiene is now being produced to sell in the range 20-25 cents, styrene at 30-35 cents, and acrylonitrile at 35 cents per pound. The August 1941 prices of natural and synthetic rubbers are listed in cents per pound as follows: natural rubber 23, neoprene GN 65, Buna S 60, Perbunan 70, Thiokol F 45, Vistanex 45, Koroseal (30% plasticizer) 60 est., Hycar OR 70. It has been estimated that on a large tonnage basis butadiene could be produced for 10-15 cents and the finished polymers for 20-25 cents per pound.

ELASTOMERS IN THE NATION'S WAR PROGRAM. W. C. Geer. Chemical Industries *50*, 22-31 (Jan. 1942). An outline of the uses to which synthetic rubber is put in the nation's war effort.

PLASTICS. Chem. and Met. Eng. *49*, 90-91, 108 (Feb. 1942). A review of production records and new developments in plastics during 1941. The prevailing prices in cents per pound for the various plastics at the close of the year are cited as follows: cellulose acetate 44, cellulose acetate butyrate 49, ethylcellulose 50, polyvinyl acetate 40, polyvinyl chloride 48, vinyl chloride-acetate copolymer 48, polyvinyl butyral 125, polystyrene 36 to 60, urea-formaldehyde molding powder 27.5 to 35 and liquid resin 22 to 24, melamine resin 55, acrylic resins 85 to 225, cast phenolics 50, and phenol-formaldehyde molding powders 12 to 60.

Materials and Manufacture

SAFEGUARDING OF HEALTH IN THE PLASTICS INDUSTRY. J. A. Cummings. Safe Practice Bulletin No. 88, Dept. of Labor and Industry, Harrisburg, Pa., Jan. 1942. Methods used in the closure plant of the Armstrong Cork Co. to reduce potential hazards in the handling of thermosetting plastics are described. A ventilated hood over the preforming machine to remove dust operates at a throat velocity of 3000 fpm. The operator of the machine is required to wear a dust mask. The flat-bed molding presses are enclosed with hoods to take care of heat and fumes. Down-draft exhaust hoods are used under the grinding machines which remove flash. Methods for detecting allergic individuals and preventing dermatitis are discussed.

CHEMISTRY OF ETHENOID RESINS. C. A. Redfarn. Brit. Plastics *13*, 281-89 (Jan. 1942). The preparation and properties of polystyrene, polyvinyl esters and acetals, polyacrylates, and polyethylenes are reviewed.

SOLVENTS AND PLASTICIZERS IN WAR TIME. A. M. Peake. Chemical Age *46*, 21-3 (Jan. 10, 1942). Recent work on the toxicity of solvents and production of alcohol from unusual sources, such as sweet millet and horse chestnuts, is reviewed. Fermentation problems, glycerol synthesis and new ester solvents are considered. Alkyl stearates, esters of phthalic and citric acids, and halogenated hydrocarbons are mentioned as the plasticizers most widely used with cellulose derivatives and synthetic resins.

Molds

METALLURGICAL PROGRESS AND THE PLASTICS INDUSTRY. British Plastics *13*, 245-6, 248, 271 (Jan. 1942). Developments in flame-hardening of dies, free-machining stainless steels, welded and sprayed metal coatings, case-hardening of 15-percent-chromium stainless steel, chromium plating of molds and other advances in metallurgy pertinent to the manufacture of plastics are reviewed. No references are cited to the original sources of detailed information on the various subjects.

Applications

THE CHEMISTRY OF DUPLICATION. John Bjorksten. Chemical Industries *50*, 68-72 (Jan. 1942). This is an excellent survey of a little publicized field in which cellulose derivatives, synthetic polymers and organic plasticizers of various types play very important rôles. The commercially successful duplication processes are discussed under three principal groups: hectograph, solvent and stencil. A bibliography of 148 patents pertaining to the subject is appended.

PLASTIC SHEET AND FILM MATERIALS. E. E. Halls. Plastics *5*, 257-60 (Jan. 1942). Chief criteria for wrapping materials are cost, availability, manipulability on packaging and labelling machinery, color, transparency, strength, permanency, inertness including lack of odor, moisture-proofness and durability under repeated manual handling. The moisture permeability of treated paper, cellulose derivative, and regenerated cellulose films is considered in detail with experimental values tabulated and graphed.

ADHESIVES INDUSTRY IS MODERNIZED. M. H. Bigelow. Chem. and Met. Eng. *49*, 121-4 (Feb. 1942). Ingredients of resin adhesives for plywood manufacture, spreading and handling equipment, pressing operations, and properties of resin-bonded plywood are discussed. Information is tabulated regarding the comparative conditions of handling and properties of plywoods bonded with animal glue, starch, blood albumen, soybean and vegetable proteins, casein, urea-formaldehyde and phenol-formaldehyde resin.

WOOD CHALLENGES THE METALS. Modern Industry *3*, 20-3 (Jan. 15, 1942). A new material—wood plus synthetic resin—has created amazing products for war and peace. Developments in airplane, glider and small boat construction with plastic-bonded plywood are described and illustrated.

Properties and Testing

TESTING ADHESIVENESS OF GUMMED TAPE. C. G. Weber. Modern Packaging *15*, 66, 68 (Dec. 1941). The device for measuring the strength of the adhesive bond or seal is made to simulate in some measure the stress exerted by the flaps of a fiber container on the seal which holds them in place. The test consists essentially in sealing two adjacent edges of a standard test paper with a 5.5-in. length of the tape in question and measuring the force required to break the seal after allowing the gum to set for a given length of time.

EFFECT OF TEMPERATURE ON THE EXCHANGE CAPACITIES OF SOME BASE-EXCHANGE MATERIALS USED IN WATER SOFTENING. H. Ingelson and A. Harrison. J. Soc. Chem. Ind. *60*, 87-92 (Apr. 1941). The influence of temperature on the stability and activity of treated coal, treated fuller's earth, quebracho-tannin resin, imported greensand, and synthetic zeolites was examined at five temperatures in the range 3 to 70 deg. C. The exchange capacity of the synthetic resin was unaffected up to 36 deg. C. Unlike the other materials, the capacity of the resin was much greater at 50 and 70 deg. C. than at the lower temperatures. From these tests it was concluded that the resin was the only material able to withstand the conditions imposed.

SHEAR STRENGTH OF MOLDED PLASTIC MATERIALS. J. Delmonte. ASTM Bulletin No. 114, 25-8 (Jan. 1942). Same as Modern Plastics *19*, 63-4, 80 (Sept. 1941) with discussion.

Ewing Galloway

U. S. Plastics Patents

Copies of these patents are available from the U. S. Patent Office, Washington, D. C., at 10 cents each

MOLDED WHEEL. R. W. Lytle (to Formica Insulation Co.). U. S. 2,267,503, Dec. 23. A molded electrically conducting wheel is made of fiber impregnated with a thermosetting binder containing a powdered conducting material.

BUTTON. F. G. Purinton (to Patent Button Co.). U. S. 2,267,667, Dec. 23. A reinforced plastic tack button has a metal shell and a premolded insert having a hub and a hole to receive a tack fastener.

STABILIZED RESINS. V. Yngve (to Carbide and Carbon Chemicals Corp.). U. S. 2,267,777-8-9, Dec. 30. Stabilizing polyvinyl chloride resins to heat by adding an organometallic lead or tin compound formed from the metal oxides or hydroxides, or an organometallic lead soap, or a tetra-alkyl tin derivative.

VARNISH RESIN. H. F. Lewis (to Institute of Paper Chemistry). U. S. 2,267,830, Dec. 30. Reacting furfural and furyl alcohol together with vinyl chloride and vinyl acetate.

TREATED FIBERS. P. Schlack (to Walther H. Duisberg). U. S. 2,267,842, Dec. 30. Improving the affinity of ethylcellulose fibers and foils for acid dyes by compounding a medium substituted ethylcellulose with a resin formed by action of 2-bromoethylamine and then of chloral on a *p*-butylphenol-formaldehyde resin.

MOLD PRESS FEED. W. Ernst and I. B. Lawyer (to Hydraulic Press Corp.). U. S. 2,268,026, Dec. 30. A feed device for an injection molding press has a motor-operated feed with an adjustable timing device for proportioning the feed.

ETHER RESIN. J. K. Simons (to Plaskon Co., Inc.). U. S. 2,268,062, Dec. 30. Heating dichloroethyl ether with sodium benzene-m-disulfinate.

COATED FABRIC. W. P. Kingsley (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,268,121, Dec. 30. Supple coated fabrics are obtained by applying several coats of a vinyl butyral resin plasticized with a sebacate of ethyleneglycol monobutyl ether.

LEATHER SUBSTITUTE. J. B. Miles (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,268,160, Dec. 30. Forming pliable spongy sheets of a cellular superpolyamide, with about 4 times the permeability (to water vapor) of an ordinary noncellular sheet of the same polymer.

HALOGENATED POLYETHENES. J. R. Myles and F. S. Bridson-Jones (to Imperial Chemical Industries, Ltd.). U. S. 2,268,162, Dec. 30. Blending two or more halogenated polyethenes, differing by 4 to 12 percent in halogen content.

BAKING ENAMEL. B. E. Sorenson (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,268,173, Dec. 30. A resin which bakes to tough waterproof films is made by condensing an N,N'-dicarbamylpolymethylenediamine with formaldehyde and an alcohol.

ACRYLATE-STYRENE INTERPOLYMERS. H. W. Arnold (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,268,177, Dec. 30. A homogeneous lightfast heat-stable interpolymer of methyl alpha-chloroacrylate and styrene in mol ratio 1: 1.

SAFETY GLASS. J. D. Ryan (to Libbey-Owens-Ford Glass Co.). U. S. 2,268,266, Dec. 30. Facing two sheets of glass with a relatively highly plasticized transparent plastic and joining them to an interlayer made of the same plastic but with lower plasticizer content.

SCOURING SPONGE. Russel B. Kingman. U. S. 2,268,403, Dec. 30. A scouring brick is made of regenerated cellulose sponge with powdered abrasive dispersed through it.

SAFETY GLASS. Adolf Kämpfer. U. S. 2,268,489, Dec. 30. In joining glass sheets to a plastic interlayer spacers made of the same plastic as the interlayer are placed at opposite edges to hold one glass sheet separate from the interlayer until they are joined by pressure.

SLIDE FASTENERS. G. H. C. Corner (to Talon, Inc.). U. S. 2,268,571, Jan. 6. Uncured or partially cured fastener units made of casein plastic are mounted on a tape stringer and adhesion is effected by the final curing.

LINEAR POLYMERS. L. Gilman (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,268,586, Jan. 6. Forming linear synthetic polymers from amide-forming compounds such as dicarboxylic acids, diisocyanates or diisothiocyanates.

FAST-SETTING INK. W. Huber (to J. M. Huber, Inc.). U. S. 2,268,593, Jan. 6. Solid ink for melt printing, comprising a hard moderately low-melting thermoplastic resin and a hard wax.

PRINTING INK. W. Huber, F. G. Breyer and L. M. Burgess (to J. M. Huber, Inc.). U. S. 2,268,595, Jan. 6. Ink for book, newspaper and magazine printing with fast smudgeless drying; comprising a hard thermoplastic resin and a plasticizer which increases the fluidity of the molten resin.

LAMINATED FOILS. J. A. Mitchell (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,268,611, Jan. 6. Two plies of moistureproof cellulosic foil are joined by facing one ply with methoxyethyl methacrylate, bringing the two plies together and polymerizing the methacrylate.

COLLARS AND CUFFS. F. T. Peters (to E. I. du Pont de Nemours and Co., Inc.). U. S.2,268,616, Jan. 6. In laminated collars and cuffs the interlayer is made of a polyamide resin derived from hexamethylene diammonium adipate and omega-aminocaproic acid.

INSOLUBLE RESIN. G. W. Rigby (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,268,620, Jan. 6. A resin which is insoluble in water, dilute acid or alkali and organic solvents is made by condensing a hydrocarbon dihalide with anhydrous ammonia.

ADHESIVE LACQUER. J. Eggert, B. Wendt and A. Jung (to General Aniline and Film Corp.). U. S. 2,268,651, Jan. 6. Compounding a cellulosic lacquer with a plastic elastic vinyl ester resin and an interpolymer of maleic anhydride with a vinyl ester or ether.

ABRASIVE DISK. P. L. Kuzmick (to J. K. Smit and Sons, Inc.). U. S. 2,268,663, Jan. 6. An abrasive tool made with metal mesh rings around a rigid disk support has the metal mesh permeated with abrasive grains and a thermosetting binder.

CONTAINER. G. A. Moore (to Humoco Corp.). U. S. 2,268,668, Jan. 6. Forming container blanks by coating sheet

(Please turn to page 74)


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material thinly with a thermoplastic adhesive, hot-pressing to the coated surface a fibrous strand also coated with thermoplastic, and forming a seam in the blank.

BLANKS. Chas. T. Dickey. U. S. 2,268,703, Jan. 6. Cutting washers from a fabric sheet impregnated with thermoplastic, aligning the washers and compacting them into a unit, then roughening the edge to expose fiber ends.

CHILD'S CUP. Geo. B. Nathanson. U. S. 2,268,768, Jan. 6. Forming a cup by coating a plastic shell thinly with a precious metal.

SOFTENER. W. König (to Rudolph Koepp and Co. Chemische Fabrik A.-G.). U. S. 2,268,832, Jan. 6. Softening regenerated cellulose or cellulose ester or ether products with potassium formate.

LAMINATED FABRICS. C. C. Quenelle and C. F. Turner (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,269,125, Jan. 6. Joining fabric plies to an interlayer of an interpolyamide derived from a diamine and a dicarboxylic acid.

ACETAL RESIN. M. Salo (to Eastman Kodak Co.). U. S. 2,269,166, Jan. 6. Acetalization of partially hydrolyzed polyvinyl esters is effected partly with a halogenated or nitrated benzaldehyde and partly with an aliphatic aldehyde not higher than butyraldehyde.

OIL-SOLUBLE RESIN. G. F. D'Alelio (to General Electric Co.). U. S. 2,269,186, Jan. 6. Refluxing amyl *p*-hydroxybenzoate with formalin in presence of a small amount of oxalic to form a resin.

VINYL ESTER. G. F. D'Alelio (to General Electric Co.). U. S. 2,269,187, Jan. 6. A chlorobenzoate of polyvinyl alcohol.

VINYL ACETALS. J. G. McNally and R. H. Van Dyke (to Eastman Kodak Co.). U. S. 2,269,216–7, Jan. 6. Forming acetal resins from partially hydrolyzed polyvinyl acetate and a mixture of benzaldehyde with an aliphatic aldehyde not higher than butyraldehyde, or with two or more aliphatic aldehydes, none higher than butyraldehyde.

PHOTOGRAPHIC SUBBING LAYER. G. F. Nadeau (to Eastman Kodak Co.). U. S. 2,269,220, Jan. 6. In photographic film with a cellulose ester support a subbing layer with low dye retention is formed of a soluble phenol-formaldehyde resin blended with gelatin or nitrocellulose.

PHONOGRAPH RECORD. J. H. Hunter (to Radio Corp. of America). U. S. 2,269,267, Jan. 6. Carbon black with oil absorptive index about 65 is used as filler in a resinous molding composition for phonograph records.

SHELLAC PRODUCT. W. F. Schaufelberger (to Harvel Corp.). U. S. 2,269,347, Jan. 6. Heating shellac with raw or polymerized cashew nut shell oil or a derivative thereof such as cardanol or its alkyl ethers or a phenolic distillate from the oil.

EXTRUSION MOLDING. Millard F. Weida. U. S. 2,269,388, Jan. 6. In an extrusion molding machine the material is prevented from backing up by arranging the plungers so that the injection cylinder is entirely closed when the piston is in the back position.

MOLDING PRESS. Millard F. Weida. U. S. 2,269,389, Jan. 6. A molding machine having a low pressure fluid cylinder with a piston rod, and a valve-operated high pressure fluid cylinder having a piston rod which acts to close the mold sections.

SANDPAPER. G. P. Netherly, G. R. Anderson and B. S. Cross; G. P. Netherly, B. S. Cross and G. R. Anderson (to Minnesota Mining and Mfg. Co.). U. S. 2,269,415–6, Jan. 6. Abrasive grains are bonded to a backing sheet by a siliceous coating and an organic adhesive gel.

HYDROCARBON RESINS. M. H. Arveson (to Standard Oil Co. of Ind.). U. S. 2,269,421, Jan. 13. Low temperature polymerization of isobutene (below −50 deg. F.) in presence of boron trifluoride.

AUTOMOBILE BODY. Henry Ford (to Ford Motor Co.). U. S. 2,269,451, Jan. 13. The frame for a plastic automobile body is made with tubular side supports along the entire length at the bottom, crosswise spring-carrying supports at front and rear, crossed diagonal auxiliary supports rising from the side supports to the roof and back and secondary tubular supports to complete the frame, all members of the frame being strongly attached at joining or intersecting points.

CASEIN PLASTICS. Christopher Luckhaupt. U. S. 2,269,464, Jan. 13. Mixing dry casein with dry ammonium acetate and molding the product while permitting ammonia to escape.

PLASTIC FROM OATS. Michael J. Batelja. U. S. 2,269,509, Jan. 13. Boiling an aqueous suspension of oat flour and compounding the resulting gel with a fibrous filler.

DECORATIVE PLASTIC. Wm. A. Darrah. U. S. 2,269,521, Jan. 13. Engraving diffraction lines on the curved surface of a molded plastic article to produce a color spectrum effect which is influenced by the color of the plastic itself.

DRINKING STRAWS. S. T. Maltby and G. B. Miller (to Stone Straw Corp.). U. S. 2,269,593, Jan. 13. Telescoping drinking straws are made from thin cellulosic membranes in tube form by heating the tube end till soft, tapering it to a smaller diameter, fitting a narrower tube into it and flaring the end of the narrow tube out to the diameter of the wider tube.

FUSED COLLAR. T. H. Swan and H. C. Donaldson (to Cluett, Peabody and Co., Inc.). U. S. 2,269,797, Jan. 13. A collar formed with front and rear fabric plies, joined by a fibrous plastic composition which is initially nonadhesive but is rendered adhesive in joining the plies.

STYRENE INTERPOLYMER. R. R. Dreisbach and Sylvia M. Stoesser (to Dow Chemical Co.). U. S. 2,269,810, Jan. 13. Interpolymerizing styrene with an alkylstyrene to form a resin.

DIE CASTING. Louis H. Morin and Davis Marinsky; Louis H. Morin (one-half to Davis Marinsky). U. S. 2,269,880, 2,269,881 and 2,269,953, Jan. 13. Die casting thermoplastics by feeding successive charges of molding composition to a die cavity by means of a plunger which alternately opens and closes the outlet of a supply container; a die casting machine having a stationary block in which dies are inserted and removed by a movable gripper block; and die casting a hot thermoplastic by intermittently forcing proportioned quantities of the hot material through the continuously heated discharge end of a supply cylinder into a die cavity.

PLASTICIZER. M. M. Safford (to General Electric Co.). U. S. 2,269,990, Jan. 13. Compounding a vinyl halide resin with methyl trichlorostearate or a methyl polychlorostearate.

IMINE POLYMERS. G. J. Berchet (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,269,997, Jan. 13. Polymerizing a monomeric *N*-sulphonylethyleneimine either alone or with a sulphur-free polymerizable ethyleneimine derivative.

POLYMER EMULSIONS. A Renfrew and W. E. F. Gates (to Imperial Chemical Industries, Ltd.). U. S. 2,270,024, Jan. 13. An aqueous dispersion of a resinous interpolymer of 2-ethylhexyl and methyl methacrylates.

CELLULOSE ETHERS. S. L. Bass and R. M. Upright (to Dow Chemical Corp.). U. S. 2,270,180, Jan. 13. Insolubilizing water-soluble celluose ether by adding to its aqueous solution a glycol-modified or glycerol-modified urea resin and heat-treating the resulting solid product. (*Please turn to page 76*)

POLYSTYRENE. W. R. Collings, G. P. Schmelter and F. E. Dulmage (to Dow Chemical Co.). U. S. 2,270,182, Jan. 13. Producing a plasticized styrene resin in powdered form by atomizing a solution of polystyrene and plasticizer with sufficient steam to evaporate the solvent.

REFINING POLYSTYRENE. R. R. Dreisbach (to Dow Chemical Co.). U. S. 2,270,184, Jan. 13. Dissolving crude polystyrene in the reflux from boiling naphtha, adding the solution dropwise to a nonsolvent and distilling the nonsolvent from the solvent while refluxing the solvent through crude polystyrene.

CONTAINERS. F. E. Dulmage (to Dow Chemical Co.). U. S. 2,270,185-6-7, Jan. 13. Making containers and closures simultaneously from a nest of shaped thermoplastic sheets by separating and trimming the nested sheets so that an inner member forms a container and an outer member forms a cap; a machine for drawing and trimming thermoplastic sheets into container and cap form; and a machine having a horizontal die with a vertical opening through which a drawing ram shapes a thermoplastic film into container blanks.

CELLULOSE ETHERS. R. M. Upright (to Dow Chemical Co.). U. S. 2,270,200, Jan. 13. Insolubilizing water-soluble cellulose ethers by adding a water-soluble polycarboxylic acid to the aqueous solution, drying the product and heating it at 120 to 180 deg. C.

WATCH STRAP. Melvin Marwil! U. S. 2,270,216, Jan. 13. Forming a wrist band of elasticized plastic material sheathed in a spiral coil.

PLASTIC GEM. Philip Clare. U. S. 2,270,270, Jan. 20. An imitation gem with a faceted transparent plastic body against a reflecting backing disk.

IMPREGNATED FABRIC. P. K. Frolich (to Standard Oil Development Co.). U. S. 2,270,285, Jan. 20. Forming a butadiene:isobutene interpolymer in the interstices of a fabric by loading the fabric with the monomers and polymerizing below −10 deg. C. with the aid of a Friedel-Crafts catalyst.

LIGHT POLARIZER. E. H. Land and C. D. West (to Polaroid Corp.). U. S. 2,270,323, Jan. 20. A highly birefringent sheet of polyvinyl alcohol with its molecules in parallel orientation.

ZEIN FILMS. R. E. Coleman (to Time, Inc.). U. S. 2,270,-508, Jan. 20. An alcohol solution of zein and a liquid modifying agent for producing hard, white, tough, opaque zein coatings.

COATED STEEL. M. H. Raney (to Anchor Hocking Glass Corp.). U. S. 2,270,662, Jan. 20. Coating steel with a tough, corrosion-resisting film of blended vinyl and phenol-aldehyde resins having sufficient flexibility to permit fabrication of the steel.

PENTAERYTHRITOL RESINS. K. Nagel and F. Keonig (to Chemical Marketing Co. Inc.). U. S. 2,270,889, Jan. 27. Making resins by condensing pentaerythritol with adipic acid and heat treating the product.

CYCLORUBBER. H. J. Cameron (to Marbon Corp.). U. S. 2,270,930, Jan. 27. Forming cyclorubber derivatives by heating rubber with phenol and a cyclizing agent, then extracting the phenol with a solvent.

SLIDE FASTENER. Martin Winterhalter. U. S. 2,270,-985, Jan. 27. Molding spaced locking members on one side of each stringer in a pair, each member having a coupling recess on one face and a coupling projection on the other.

INJECTION MOLDING. Peter De Mattia. U. S. 2,271,-019, Jan. 27. An injection molding machine in which a bell crank lever is operated by a power lever through two cams which control the motion as required.

MOLDING MACHINE. Peter De Mattia. U. S. 2,271,063, Jan. 27. A machine in which molding composition is forced by a piston under pressure into a die, with provision for follow-up feed of composition to the die before the piston is retracted.

POLYMER. M. Pier and F. Christmann (to Wm. E. Currie). U. S. 2,271,093, Jan. 27. Reacting a polymerizable arylolefin with an aryl or alkyl halide to produce a polymeric product with high molecular weight.

TREATING FOILS. G. Hinz (to Sherka Chemical Co.). U. S. 2,271,192, Jan. 27. Articles cut or stamped from organic plastic sheeting are improved by being rolled and treated, in vacuum, with a swelling medium to which only the cut edges are exposed.

INSULATED WIRE. H. A. Smith and E. H. Jackson (to General Electric Co.). U. S. 2,271,233, Jan. 27. A wire enamel contains a superpolyamide and a thermosetting phenolic resin in a solvent.

INTERPOLYMERS. H. W. Arnold (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,271,384, Jan. 27. Homogeneous emulsions of 3-component interpolymers containing butadiene, a vinyl ester and an acrylate ester as polymer members.

VINYL ALCOHOL. W. W. Watkins (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,271,468, Jan. 27. Plasticizing a water-soluble polyvinyl alcohol resin with ethanolammonium chloride.

SHOE STIFFENER. C. H. Boys (to Hercules Powder Co.). U. S. 2,271,474, Jan. 27. Impregnating a fiber base with natural or synthetic rubber compounded with hydrogenated rosin or a hydrogenated rosin ester.

NONGELLING FINISH. C. Bogin (to Commercial Solvents Corp.). U. S. 2,271,581, Feb. 3. Preventing gelation of a tough, strong vinyl chloride: vinyl acetate resin finish by using a blended solvent containing a nitroparaffin and a coal tar hydrocarbon.

HYDROCARBON POLYMERS. P. K. Frolich (to Standard Oil Development Co.). U. S. 2,271,636, Feb. 3. Polymerizing unsaturates from cracked petroleum distillates to a plastic solid state in presence of a halide polymerizing catalyst.

ACETAL RESIN. D. R. Swan (to Eastman Kodak Co.). U. S. 2,271,668, Feb. 3. Acetalizing partially hydrolyzed polyvinyl acetate with acetaldehyde and butyraldehyde in such proportions that they react approximately in the mol ratio 60:40.

HIGH GLOSS FOILS. W. S. Traylor (to Hercules Powder Co.). U. S. 2,271,724, Feb. 3. Coating a cellulosic foil with a melt of ethylcellulose and a rosin-modified alkyd resin to form a high gloss nontacky scuff-resisting coated foil.

PLYWOOD. Jas. V. Nevin. U. S. 2,271,744, Feb. 3. Facing a core of wood with veneer sheets and bonding the assembly under heat and pressure with a partially resinified formaldehyde: cresylic acid condensation which sets when hot pressed.

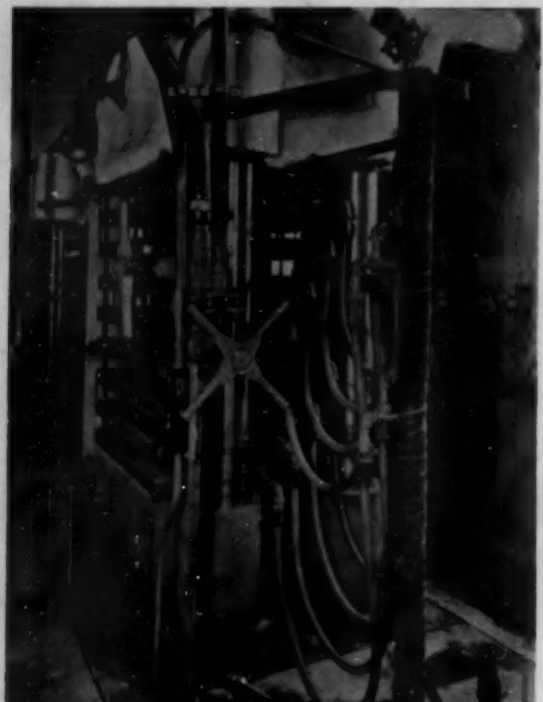
CLOSURE. W. F. Schmalz; B. F. Connor (to Colt's Patent Fire Arms Mfg. Co.). U. S. 2,271,746; 2,271,747, Feb. 3. Molding a waterproof, chemically inert synthetic resin applicator rod into a closure made of a less resistant resin composition; and molding such an applicator rod into a molded closure by means of an enlarged end which prevents withdrawal of the rod.

HECTOGRAPH BLANKET. W. J. Champion (to Ditto, Inc.). U. S. 2,271,758, Feb. 3. The copy mass of a hectograph blanket is made of a hydrophilic cellulose derivative gel.

RESISTOR. G. E. Megow and H. G. Thomson (to Allen-Bradley Co.). U. S. 2,271,774, Feb. 3. A molded insulated resistor has a solid sleeve of polymer resin binder and a core with conductor particles embedded in the pores.

Machinery and Equipment

★ ECLIPSE AVIATION FLEXIBLE METAL HOSE (below), put on the market by Bendix Aviation Corp., is said to be of improved seamless corrugated construction, available in a large variety of special alloys not previously used for this product. The hose may be used in industrial and domestic oil burner installations, in the manufacture of plastics and other products where connections must be made from steam lines to molds. Illustrated below is an installation of this latter type shown on a Birdsboro hydraulic press. Other fields suggested for this hose are refrigeration and air-conditioning, airplane construction and for use on exhaust pipes and vibration eliminators on boats and industrial machinery.



★ FOR INCREASING COMBUSTION EFFICIENCY AND eliminating smoke nuisance in manufacturing centers, Photoswitch, Inc., has designed a new photoswitch smoke alarm, Type A25C. The photoelectric control and light source are mounted on opposite sides of a smoke stack so that the beam projects to the photoelectric eye. Lens design minimizes its collecting soot and dust. At some convenient point in the plant is located the densometer, or indicator, which shows the engineer whether combustion is efficient (green light) or whether excessive smoke is passing through the stack (large red bulls-eye).

★ FOR USE WITH ONE OR MORE SMALL BUFFERS, polishers, cut-off machines and bench and pedestal grinders is Aget-Detroit Manufacturing Co.'s Dustkop, a self-contained dust collector which need not be connected to a centralized collecting system. Rated capacity of the unit is 600 cfm, and its 110-volt motor provides a water-lift of approximately 3.3 inches. Two types of intake flange are provided to exhaust stations singly or in multiple; and removal of débris is effected by lifting out the pan under the filter assembly.

★ BLACK & DECKER HAVE ADDED A 9-IN. HEAVY-duty sander (above) to their line of portable electric tools. Designed for production-line use, the sander has 9-in. abrasive disks, a Universal motor, a spindle lock for quick change of disks and pads. This largest of the company's sanders is employed for general cleaning and sanding operations on large areas only, may be used to perform these operations on plastic forms and for cleaning molds.

★ HISLEY-WOLF MACHINE CO. PUTS ON THE MARket a combination exhauster and filter in 4 sizes with rated capacity of 630 to 1336 cfm. A cyclone collector removes coarser particles from the air and the impingement-type filter catches the fine dust. Motor is externally mounted. The company also manufacturers an exhauster without filter.

★ WALKER-TURNER CO., INC., HAS A NEW FOOT-operated speed lathe (above) said to be useful for many jobs now being done on conventional lathes, or similar machines. Some of its uses are for polishing, burring and lapping on ferrous metals, non-ferrous metals and plastics. It will chuck rounds, tubing and hexagonal shapes up to 2-in. diameter. Lathes have 3-phase motors in direct drive or geardrive types, foot pedal controls, which connect motor switch and synchronized brake to hold spindle stationary while changing work in the chuck.

Publications

Write direct to the publishers for these booklets. Unless otherwise specified, they will be mailed without charge to executives who request them on business stationery. Other books will be sent postpaid at the publishers' advertised prices

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Protective and Decorative Coatings. Vol. I. Raw Materials for Varnishes and Vehicles

Joseph J. Mattiello, Editor
Published by John Wiley and Sons, Inc., New York, 1941
Price $6.00 **819 pages**

Fundamentals in the technology of protective coatings are emphasized in this comprehensive treatise prepared with the collaboration of specialists in the various branches of the subject. The past, present and future of the paint and varnish industry are reviewed in an introductory section. Drying oils of all types are considered with special chapters on the cashew, oiticica, castor and synthetic varieties. The resinous raw materials receive particular attention and are considered under the following subdivisions: Rosin, various natural resins, shellac, ester gum, copal ester, phenolics, alkyds, coumarone-indenes, urea-formaldehydes, maleics, vinyls, cyclized rubber, chlorinated rubber, acrylics, hydrocarbon resins of the Petropol and chlorinated diphenyl types and aryl sulfonamide-formaldehyde resins. Solvents and thinners are discussed in five chapters dealing with terpene solvents, petroleum thinners, high-solvency naphthas, coke-oven light-oil distillates and lacquer solvents. There are also special sections dealing with paint driers, asphalts and asphalt paints and ethylcellulose coatings.

The editor notes in his preface that "the paint and varnish industry is in process of transition. Its growth has been a development of the arts, but now the industry is on the threshold of becoming a science. The newer developments in synthetic resins, synthetic oils, new pigments, and solvents are the results of researches in pure science made applicable to the needs of the industry. The future will have many scientific surprises for the industry."

Statistics published in the February issue of MODERN PLASTICS indicate that approximately 42 percent of plastics production in the United States now goes into paints and varnishes. The estimates for further expansion of productive capacity for plastics show that manufacturers of these materials can be expected to continue to play a vital part in the protective coating industry. Every new synthetic resin emerging from the laboratory is of potential interest alike for moldings, coatings and the other diversified applications of plastics, and it is certain that there will be a resumption of the annual appearance of newly created resinous products when the need for concentration of production on established items has passed. Accordingly, the surveys of modern coatings contained in this book should be of definite interest to manufacturers of plastics as a guide to present and future requirements of the paint and varnish industry.

The author and publisher are to be congratulated on providing a thorough survey of this important industry during a critical period when such information is vitally needed. The excellent physical make-up of the book merits especial recognition. It is planned to extend this treatise by the publication of two further volumes, one dealing with pigments and the other with manufacturing problems and special studies. G. M. K.

★ WHITMAN & BARNES OF DETROIT, DIV. OF UNITED Drill and Tool Corp., have recently issued a booklet with the title "Drill and Reamer Facts." The design and construction, use and care of drills and reamers are discussed there.

General Plastics

by Raymond Cherry
Published by McKnight and McKnight, Bloomington, Ill., 1941
Price $1.20 **128 pages, 169 illustrations**

The adventurer who has an urge to do his own fabricating with plastics will find ample directions for such craft work in this book. The tools and supplies needed and the fundamental operations involved in fashioning plastics are described in detail. The layouts and step-by-step procedures for forty-two projects are given. An introductory section serves to acquaint the beginner with the terminology and classification of plastic materials. The book is one of a series of texts on industrial arts by the same publisher.
G. M. K.

★ ELMER E. MILLS CORP., 812 W. VAN BUREN ST., Chicago, has issued a new edition of "Injection Molded Plastics," a 32-page booklet, profusely illustrated with four-color and black and white photographs of its work. Included are data on the thermoplastics and methods of handling them. The company has another pamphlet on Mills Plastic which is its trade name for products made of Saran, vinylidene chloride plastic.

★ AN EXCEPTIONALLY COMPLETE 140-PAGE FASTENing data book has been issued by Shakeproof Inc., 2501 N. Keeler Ave., Chicago, giving full technical information on the thread-cutting screws and speed-fastening devices made by the company. Application suggestions for saving time and improving performance are included. A special section is devoted to Government specifications and approvals.

★ "ITS A NEW BUSINESS CUSTOM" IS THE TITLE OF an attractive booklet of case histories recently issued by Durez Plastics & Chemicals, Inc., North Tonawanda, N. Y. These represent a cross section of a variety of products made from the company's phenolic molding compounds.

★ THE AMERICAN SOCIETY FOR TESTING MATErials has issued a 4000-card file index of X-ray diffraction data for use in the Hanawalt method of chemical analysis by X-ray diffraction. The National Research Council was likewise represented on the committee, headed by Prof. Wheeler P. Davey, of Pennsylvania State College, which sponsored the compilation. To Hanawalt's original data and later corrections have been added material contributed by Aluminum Co. of America and New Jersey Zinc Co., and taken from the literature. The index identifies the three strongest lines in the X-ray diffusion pattern of some 3000 crystalline compounds.

★ "BAKELITE SEALING SOLUTION FOR POROUS Castings," a 4-page folder put out by the Bakelite Corp., 30 E. 42nd St., New York City, explains the reclamation of leaky metal and alloy pressure castings by impregnating them with these solutions. Instructions are given for applying solution to casting and for the subsequent baking operation.

★ RESINOUS PRODUCTS & CHEMICAL CO., 222 W. Washington Square, Philadelphia, announces a new non-phenolic resin, Amberol 925, in a pamphlet of that name. Composed of chemicals still relatively available for civilian needs, Amberol 925 is offered to coatings manufacturers for use in the preparation of enamels, and of varnishes of all oil lengths, for both air-drying and baking finishes. The new resin is suggested for investigation in cases where Amberol F-7 (now used exclusively for defense applications) was formerly employed, although there are, as the firm points out, some differences in results obtained.

★ THE 1942 EDITION OF ENGINEERING PROGRESS, the annual review of its outstanding developments during the past year put out by the Westinghouse Electric & Manufacturing Co., is just off the press. The 40-page booklet contains individual accounts of 60-odd Westinghouse products, with photographs.

Where the job is important...

Product illustrated, courtesy American Insulator Co.

FLASH removal and finishing jobs present a variety of problems. Not only do different plastics have varying qualities of hardness and brittleness, but frequently there are recesses to be reached, corners and angles to be cleared out, bevels to be trued, slots to be enlarged, working fits to be made.

What are your problems? Nicholson research has studied plastics and is ready to recommend *The right file for the job.* Nicholson is prepared to assist the molder in dealing with any special or difficult finishing, or the fabricator in assembling plastic parts with those of other materials.

Send us a description of your product, material, and finishing problems. For your file needs, contact your mill-supply house.

NICHOLSON FILE CO., PROVIDENCE, R. I., U. S. A.
(Also Canadian Plant, Port Hope, Ont.)

NICHOLSON *and* BLACK DIAMOND *Files for Plastics* come in shapes, cuts and sizes for work on corners, slots, holes, curves, thin sections, flat areas; on hard, soft, brittle or "shreddy" material. Sharp, thin-topped teeth, with wide rounded gullets to minimize clogging, characterize most of the Flat, Mill, Square, Round and Half-round files recommended for plastics. Several of the X. F. (Extra Fine) Swiss Pattern variety, including Knife and Pillar, are also suitable.

NICHOLSON FILES
FOR EVERY PURPOSE

In the plastics picture

★ A.S.T.M. COMMITTEE D-20 ON PLASTICS, MEETING in Philadelphia on February 19 and 20, elected the following officers whose term of office begins at the close of the annual meeting in June: Chairman, Robert Burns, Bell Telephone Laboratories, Inc.; First Vice-Chairman, H. K. Nason, Monsanto Chemical Co.; Second Vice-Chairman, D. L. Gibb, Dow Chemical Co.; Secretary, L. W. A. Meyer, Tennessee Eastman Corp. Subcommittee I on Strength Properties reported progress on the preparation of test methods dealing with compression, fatigue, shear, bearing, repeated impact and modulus of elasticity properties. Subcommittee II on Hardness Properties had tensile creep and mar resistance methods ready for approval and were working on scratch hardness, indentation hardness, machinability and wear resistance of bearings. Subcommittee III on Thermal Properties are working on the determination of coefficient of linear expansion, ignition point, cup flow and softening point. Subcommittee IV on Optical Properties approved a method for determining haze of plastics for submission to the Committee for adoption as a tentative standard and considered methods for determining surface irregularities of transparent plastics. Subcommittee V on Permanence Properties reported that methods for measuring the permeability of plastics to moisture and for the determination of the effects of heat and accelerated service conditions on plastics were ready for circulation for comment. Sub-committee VI on Specifications reported progress in the preparation of tentative drafts covering various plastic materials and products.

★ "WHAT IS RESEARCH?" WAS THE TOPIC OF THE evening when the American Section of the Society of Chemical Industry met with the American Institute of Chemical Engineers in New York City on Feb. 20. Dr. Lincoln T. Work, Research Director at the Metal and Thermite Corp., opened the meeting with a discussion of the many-sided meaning of the word "research," and subsequent speakers on the program treated the subject from the points of view of the consultant, the industrialist and the research institution.

★ NEW ACTING CHIEF OF THE PLASTIC UNIT, ORganics Section, Chemicals Branch, WPB., is Dr. R. H. Ball, formerly of the Plastics Div., Celanese Celluloid Corp.

John M. De Bell, Longmeadow, Mass., one of the judges in the 1941 Modern Plastics Competition and a plastics consultant, is now serving WPB as a consultant. R. C. Martin, consultant and author of "Lacquer and Synthetic Enamel Finishes," is now a member of WPB's Chemicals Branch. Nils Anderson, formerly with the Bakelite Corp. as sales engineer specializing in plywood resins, is attached to the same branch as an analyst.

★ DR. G. FRANK D'ALELIO HAS BEEN APPOINTED chemist of General Electric Co.'s plastics department, to be in charge of the company's laboratories and research activities with headquarters in Pittsfield, Mass., where the principal unit of the plastics division is located. Dr. D'Alelio obtained his Ph.D. in chemistry at Johns Hopkins, and came to G E in 1936.

★ KENNETH VANDENBREE OF JOHN ROYLE & SONS, makers of extruding machines, Paterson, N. J., has been made director of sales for that company.

★ H. MUEHLSTEIN & CO., INC., 122 EAST 42ND ST., New York City, for many years importers of crude rubber and dealers in scrap rubber, have entered the plastics field, where they will specialize in finding new markets for waste products and directing the flow of such products into the proper channels.

★ A NEW LUMINESCENT PIGMENT, LUMIPLAST, has been developed by Technicraft Co., 121 E. 24th St., New York City, for adding to thermoplastic molding powders. It comes also in liquid plastic form. The company states that Lumiplast contains no radium or phosphorus, is non-toxic, and can be applied to any fabric, material or paper with no injurious effects. Recommended by its makers for blackout purposes, it can also be used for decorative and commercial applications such as advertising displays, house and highway markers, safety signals and in other places where interruption of light would be undesirable.

★ A NEW TYPE OF VINYL BASE PAINT COATING, called Amron, has been developed by U. S. Stoneware Co., Akron, Ohio, designed for service where corrosion resistance is important. Without sacrificing any of the inherent qualities of the vinyl resin, the company reports it has developed a formulating technique that permits air drying where baking was heretofore essential. The coating is said to incorporate the following characteristics of vinyl resins: excellent resistance to acids, alkalies, certain hydrocarbons, salt water and virtually all weather conditions; high film strength and high dielectric strength. It is recommended by the company for use as tank lining material and commercial coating material where such qualities are of advantage.

The application of this coating requires the use of a single coat of Amron primer, followed by multiple coats of the finish, the number of coats depending entirely upon the specific service demanded. A variety of colors is available. By varying the percentage of solvent, this vinyl base coating may be applied by dipping, brushing or spraying. Where a fast-drying cycle is required, forced drying may be employed with equally satisfactory results, it is reported.

For heavy duty industrial applications where resistance to corrosion and to chemical solutions is essential, the company has produced a synthetic resin formulation, called Tygon, commonly classified as a "modified halide polymer."

★ HERCULES POWDER CO., WILMINGTON, DEL., announce that they are now producing para-cymene (structurally para-methyl isopropyl benzene) from liquid terpenes, and that a new unit for production of the material is nearing completion at Brunswick, Ga., where their naval stores plant is located.

★ LEA MFG. CO., WATERBURY, CONN., HAS TAKEN over sales and distribution in southwestern New England of the Paasche line of lacquer and paint-spraying equipment made by Paasche Airbrush Co. of Chicago. The company is the manufacturer of an abrasive composition for use in burring operations.

★ A NEW MOLDING COMPANY, PERFECTION PLAStic Products, located at 900 Passaic Ave., East Newark, N. J., is equipped to do molding of thermosetting materials both on automatic and on semi-automatic presses.

★ DESPATCH OVEN CO. HAS MOVED ITS PURCHASing, engineering, sales and executive offices to 722 Central Ave., Minneapolis, Minn. This move provides for increased manufacturing and assembly facilities at the factory, 622 9th St., S. E., in that city. Harold W. Munday will act as their district engineer in the Chicago territory.

★ THE PRINTING MATERIALS DIVISION OF BAKElite Corp., unit of Union Carbide and Carbon Corp., has moved from Bloomfield, N. J., to 300 Madison Ave., New York City. In addition to sales engineering offices, a small laboratory has been completed for development work on Bakelite printing materials, including the plastic printing plate products designed to replace electrotypes and stereotypes. Eugene Williamson heads the division. Bakelite has also opened a new sales office for the company's varnish resins at 2506 May St., Cincinnati, which Robert B. Waters will direct. *(Please turn to page 84)*


Offset Printing Department
Letter Press Printing Department
ssembly Department—Hand Operations
Laboratory
ie and Tool Department
Spraying Department
Modeling Department
Inspection Department
Extrusion Molding Department
Polishing Department
Assembly Department—Machine Operatio
Conveyor Assembly Lines
Engraving Department
Foil Stamping Department
PLANT PROTECTION
★ PLANT PROTECTION SYSTEMS ★
available only to firms
doing defense work . . .
★
Write for this booklet. It clearly explains employee identification systems.
PLASTICS
molded, fabricated, extruded.
Cruver
MANUFACTURING COMPANY
CHICAGO · · · NEW YORK
2456 W. JACKSON BLVD.
Seeley 2434
2 WEST 46TH STREET
Wisconsin 7-8847

Government and Industry

★ AS OF FEB. 23, ALL STOCKS OF CHLORINATED rubber were frozen preparatory to requisitioning by the WPB or diversion into war production. By amendment to General Preference Order M-46, chlorinated rubber may now be used only for: Painting arsenals, ship bottoms, submarines and industrial plants where resistance to chemical corrosion is necessary; flameproofing military fabrics; tracer bullets; fastening rubber articles to metal; electrical insulation. Civilian uses prohibited by the amendment: Masonry paint; greaseproofing treatment of fabrics, paper, printing ink; bottle cap closures; paint finishes.

★ CONSERVATION ORDER M-29-b, ISSUED FEB. 14, prohibits the use of tungsten, needed for alloy steel, in grinding wheels, gages, and as coloring material for rubber, linoleum and similar materials after May 1. All other users of tungsten, except those specifically exempted, are limited to 17¹/₂ percent of the amount used during the year ended June 30, 1941. Among those exempted from the provisions of this order are makers of: Corrosion-resistant material; hard-facing material; laboratory, research, radio, x-ray equipment; filament and fluorescent lighting.

★ THE WPB ON FEB. 18 EXTENDED TO APRIL 30 ITS P-38 Order assigning an A-1-d preference rating to deliveries of material that will enter into the production of radiosondes for the Weather Bureau. The radiosonde is a miniature radio transmitter sent aloft in a free balloon to record and transmit to earth records of atmospheric pressure, temperature and humidity. It contains molded urea and phenolic structural parts and a tiny polystyrene lens.

★ THE CELLOPHANE ORDER (LIMITATION ORDER L-20) was on Feb. 16 extended for another month, or until March 17. Provisions of the Order, which limits the use of cellophane and similar cellulose-derived material, were covered in the February issue, page 88.

★ DR. ERNEST W. REID, ASSISTANT CHIEF OF THE Chemicals Branch, WPB, has been appointed Chief of the Branch, replacing Dr. Edward W. Weidlein, who remains as senior consultant, and will devote much of his time to work on the synthetic rubber program. Both men are from the Mellon Institute, Pittsburgh.

★ THE USE OF CRITICAL MATERIALS IN THE MANUfacture of musical instruments is curtailed by General Limitation Order L-37. The program covers the period from Mar. 1 to June 1, during which period manufacturers are limited to amounts based on their 1940 consumption and graduated according to the percentage of such critical material contained in their products. Phenol formaldehyde plastics is among the materials affected.

★ J. S. KNOWLSON, DIRECTOR OF INDUSTRY OPERATIONS, WPB, has issued General Preference Order No. E4 to cover the sales and deliveries of second-hand machine tools. To date, such tools have been under very little priority control, and many that are urgently needed by critical industries have consequently been purchased by companies not directly engaged in war production. The new order makes all provisions of Priorities Regulation No. 1 apply to second-hand tools in the same manner as they apply to sales and delivery of other merchandise.

★ REGULATIONS GOVERNING RECEIPTS AND SHIPments of ethyl alcohol and related compounds controlled by General Preference Order M-30 have been revised under the terms of Amendment 3 to the original order. The definition of ethyl alcohol is changed to indicate that alcohol for industrial purposes only is meant. Proprietary solvent is included in this definition. Restrictions on receipts will henceforth be by quarterly periods rather than by months. Restrictions on producer's deliveries are rescinded.

★ PREFERENCE RATING ORDER P-89, ISSUED JAN. 26, gives the war chemical industry a high priority in securing necessary repair, maintenance and operating supplies. An A-1-a rating is given to deliveries of material to repair actual breakdowns; A-1-c to materials required to avert immediate threatened stoppage; A-3 to materials for other repairs, maintenance and operation. Before applying for any of these ratings, a manufacturer must file with the Chemicals Branch a statement setting forth certain required information and be assigned a serial number under the order.

★ THE OFFICE OF PRICE ADMINISTRATION HAS established by Price Schedule No. 79 maximum prices for carbon tetrachloride, in face of threatened shortages of chlorine, used for its manufacture. Carbon tetrachloride, an ingredient of cleaning fluids, fumigants, refrigerants, is presently used for the cleaning of machine tools and metal parts.

★ THE DIVISION OF INDUSTRY OPERATIONS, WPB, has a new form of application blank for individual preference ratings the use of which is mandatory on and after March 2. Use of the new form is covered by Priorities Regulation No. 3. Most important feature of the new system of granting individual preference ratings is that these ratings may now be extended to suppliers and sub-suppliers of the original applicant by a simple endorsement on the purchase order. The new form, PD-1A, may be obtained from the Director of Priorities in Washington or from any of the Priorities Field Offices.

★ THE PREFERENCE RATING ORDER GRANTING priority assistance to research laboratories may not be applied to obtain material to be used in the construction of laboratory buildings or other structures, according to a recent ruling made by the Priorities Division. The only material which may be obtained under the Order by a laboratory is that which will itself be used in the conduct of scientific research or which will enter into the production of material which will be so used.

★ DONALD M. NELSON, CHAIRMAN OF THE WAR Production Board, announced February 2 the adoption of a system of daily progress reports by which top officials of the production program will be kept constantly informed of the exact status of all phases of the program, and will be able instantly to discover the location and the cause of production delays anywhere along the line. The system, devised by Stacy May, chief of the Progress Reporting Division, will work as follows:

The Progress Reporting Division will keep detailed reports up to date on each of the 300 principal military items being produced. Each day the chairman and top officials of the Board will receive a report sheet showing current progress on such items as need attention. For each of those items, the sheet will show the total quantity which must be delivered during the current month in order to meet the goal set by the President. In addition, it will show the quantities delivered each day during the month, presenting a cumulative total so that a glance will show whether the program is being met for each item.

If any item is behind schedule, a break-down report will be called for, to determine which component part of that item is lagging and causing the delay. The Progress Reporting Division will then have available for the chairman additional reports, compiled either monthly or bimonthly, showing the production of the various components by the individual manufacturers. Thus it will be easy to discover exactly which manufacturers of a given component part are not delivering on time and are responsible for the resulting bottleneck.

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When you are confronted with an urgent need for increased production in connection with the U. S. armament program—check into the possibilities of these Delta machines. Here is a 6" Abrasive Belt Finishing Machine that is heavy and husky enough to do any of the dozens of sanding, polishing and finishing operations to be found around the average shop, yet which is portable enough to be used just where it is needed. It has found wide acceptance for finning, finishing and surfacing metal and plastic parts. Every feature has been designed to eliminate disadvantages usually found in small belt polishing machines. The frame is heavy and substantial; the adjustments convenient and positive in action; attachments are quickly attached or removed; the machine may be used either vertically or horizontally, as required. It is completely guarded, and dust removal may be made efficiently. It is completely ball-bearing equipped with double-seal bearings, lubricated at the factory for life. There is no rubber covering required on the drums which eliminates one source of replacement expense.

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Made on two models; one a direct-drive unit employing either a ½ H.P. or a ¾ H.P. ball-bearing motor. The disk in this unit fits directly onto the end of the motor shaft, making the machine completely self-contained. The other model is a belt-drive unit, which makes it possible to use any motor available, to use motors built for odd frequencies or voltages and to vary the speed to suit individual operations.

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Plastics Industry Conference

A CONFERENCE sponsored by the Society of the Plastics Industry was held in Washington, D. C., on March 2 to hear representatives of the armed forces of the United States discuss the country's war needs as they affected the plastics industry. Some 175 representatives of the industry attended.

Presiding Officer Ronald Kinnear, President of the SPI, opened the meeting by voicing the desire of the industry to cooperate fully in carrying out the war program, and stressing the need for specific information on the proposed use by the Government of the industry's productive facilities. Frank Warner, Chairman of the SPI Technical Committee, then mentioned briefly the work done by his group in rendering technical aid to those governmental divisions requesting it; and explained the steps taken at the Dayton, Ohio, meeting in January (MODERN PLASTICS, Feb. 1942, p. 84), regarding plastics in military aviation.

Mr. Kinnear then introduced the first speaker, Capt. E. L. Hobson, of the Quartermaster Corps, who began by explaining that the standardization branch of the Quartermaster Corps was expected to develop and write up specifications for the best available plastic materials they could find for each particular job under consideration. All parts must stand up under a temperature range of −60 deg. F. to 170 deg. F., as well as pass strict Army specifications determined by actual service and field tests. Because of their strength and durability, thermosetting materials were preferred.

The following plastic items, Capt. Hobson said, have already been adopted by the Army: Helmet liners, knife handles, canteen caps, buttons, small faucets for canvas water bags—all in phenolics. Combs, soap containers were approved in acetates.

At the present time the following items are under consideration: Canteens, memorial tubes, belt buckles, goggle lenses, mess kits, canteen cups, lacings for snow shoes, identification tags and thunder whistles. Some of these items appear to be impracticable for the plastic materials known today, because of exceptionally high temperature requirements—for example 3000 deg. F. for identification tags or, for canteen cups, heat sufficient to boil water.

Captain Hobson also explained that his Division was developing clothing and equipment for civilian defense, women's auxiliary, Army specialists corps and civil air patrol, which would undoubtedly require some plastics. Lack of rubber has forced use of plastic waterproof material for raincoats and similar equipment. They are now testing vinyls and ethyl cellulose coated fabrics for these purposes. In closing, Capt. Hobson thanked the industry for its assistance in developing plastic parts.

Albert Philipson, of the Quartermaster Corps legal department, explained very clearly how to go about securing Government business, with particular reference to purchases made by his Division. He advised plastics men to call on the Quartermaster field office representatives, and indicate to them which of the products now being purchased by the Corps their plants can furnish. Mr. Philipson emphasized that these field offices specialize in the *purchasing* of supplies. Manufacturers still in doubt after conferring with them should write the Purchase Information Branch of the Contract Division, Office of the Under-Secretary of War, Washington, D. C., specifying what their plants are tooled up to produce. After getting from the Information Branch the addresses of depots buying the products they wish to supply, manufacturers should ask to be placed on such depots' bidder's lists. It is not necessary to hire an agent to secure direct contracts; in fact, the Government divisions would rather deal directly with prime contractors, and each contract definitely specifies that no fee has been paid to secure the business. Awards are made at procurement depots; and price, prompt deliveries, quality of product, fair labor practices, geographic location and transportation are taken into consideration. Contracts are, therefore, not always awarded to the lowest bidder. Speed, not cost, is dominant today.

The next speaker, Colonel M. B. Chittick, Chemical Warfare Service, U. S. Army, began by thanking the industry for the help they had so generously given in developing CWS plastic parts. This Division follows the regular procedure for adopting industrial developments and should be addressed either through the Chief of Technical Service, CWS, in Washington, or through the Technical Office of the Edgewood Arsenal, Edgewood, Maryland. CWS uses of plastics are confined largely to gas mask parts, outlet valves, outlet valve guards, outlet valve diaphragms, angle tubes and lenses. Other parts used by the Service, Col. Chittick explained, require better structural and chemically resistant materials than are now available. He suggested that those having specific ideas should communicate with the Service so that their suggestions might be given consideration. The Chemical Warfare Service is now experiencing some difficulty with the performance of parts in the field, presumably because different materials were apparently used by their several manufacturers in producing such parts. Colonel Chittick would like to see some improvement in plastic materials used for the Service's work.

J. B. Lunsford, Bureau of Ships, U. S. Navy, explained that his division did not look at plastics as "plastics" but rather as specific items, such as cables, connectors, panel boards, junction boxes, etc. He stated conclusively that it was impossible to think of anything electrical without thinking of plastic materials. To make a complete electrical unit requires first, a conductor; second, insulation; third, a magnetic current; and fourth, coordinating means or framework tying the first three parts together.

Because critical metals predominate in these parts, there must be more substitutes, and plastics—the only material lighter than metal—are therefore indicated. Better, higher impact plastics must be developed if they are to be used more extensively in Navy equipment. Navy specifications are drawn up to approximate field and service conditions. Materials must be tested within 25 days to determine whether they will stand up for 25 years. Mr. Lunsford suggested that the industry stop whetting civilian appetites for plastics containing raw materials on the critical list and try to produce better parts from, and think up new applications for, materials which are plentiful.

Lieut. E. T. McBride, Ordnance Department, U. S. Army, then called attention to the very thorough search for plastic substitutions which has been carried on by his Department. Military objectives must be known in order to specify requirements. The availability of materials must be considered, and the ability of parts made from them to stand periods of storage under various temperatures and relative humidity conditions. From this standpoint, thermosetting materials are most desirable for Ordnance work, especially ammunition. Gun stocks, cartridge belt links, grips and handles for machine guns made of phenolics are being tested. Bayonet scabbards of duck impregnated with cellulose acetate butyrate have been approved, although experimental work is still proceeding on phenolic scabbards. The M-52 fuses in flock-filled phenolics, while not as yet completely tested, will undoubtedly be approved. The Army requires exceptionally stable materials with high structural strength to stand gun setback. The 75-mm. windshields are unsatisfactory in the present design. Plastics have been approved for the 37-mm. windshields but are more expensive than powdered, pressed iron. In aviation ordnance, bomb-burster tubes and flare bases are satisfactory. Fire-control components, including hand wheels and knobs, could be used. Reinforced hand wheels for artillery are now under test. Transparent blisters for tanks to protect officers from dirt, dust and gas fumes, are under consideration. Various gage handles are satisfactory in acetate, butyrate and ethyl cellulose. In closing, Lieut. McBride thanked the industry for its cooperation in development work and in production of approved applications.

A general, informal discussion period for members of the industry followed the adjournment of the all-day session.

America's Plastics Exhibit—Middle West

THE huge, enthusiastic attendance that continues to greet America's Modern Plastics Exposition, the unique educational exhibit touring the country, has a two-fold significance. Not only is this department store show doing a tremendous job of telling the consumer, retailer and industrialist about plastics, but it also represents the splendid efforts of large retail establishments to indicate their confidence in the future, by their willingness to continue to educate the public and their own organizations.

The scope of the exhibit can be seen in photographs taken at two presentations in the midwest area. Figures 1–2 picture the interior set-up and one of the window displays at the J. L. Hudson Co. store, Detroit, Mich., where the Exposition set a three weeks' record in conjunction with the store's 10th Annual Housewares Show. Over 150,000 visitors were reported.

Next stop of this traveling cavalcade of plastics was Akron, Ohio, where it opened on February 6 in the auditorium of the A. Polsky Co. department store. Figures 3–5 illustrate part of the display and close-ups of some of the highlights. Then the exhibit went to Stix, Baer & Fuller, St. Louis, Mo., for a 10-day showing, Feb. 16–28.

The complete story of the exhibit has been told in previous issues, but to really appreciate it, you must see it for yourself.

The next showing of the Exhibit will be at J. Goldsmith & Sons Co. store in Memphis, Tenn., March 9 to 14.

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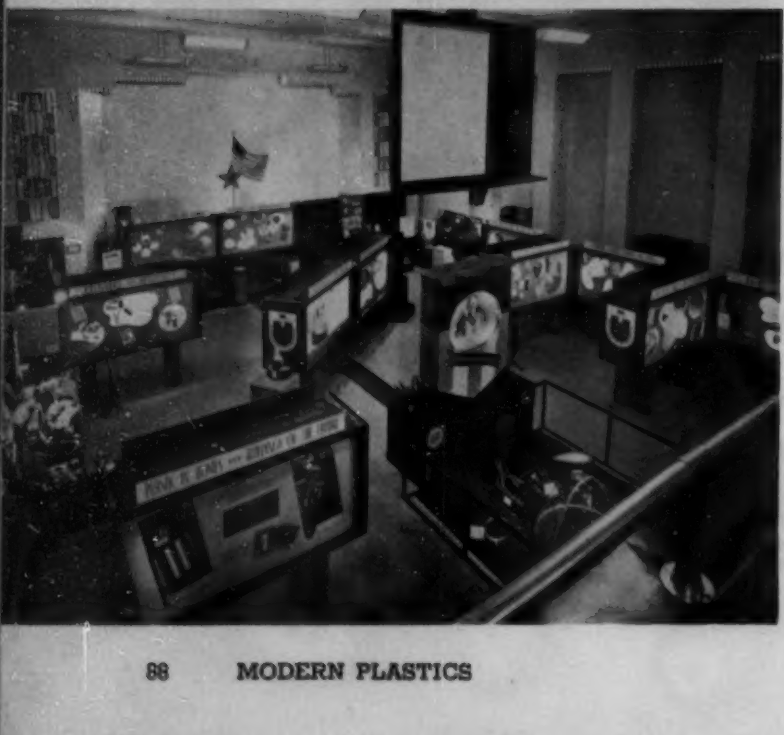

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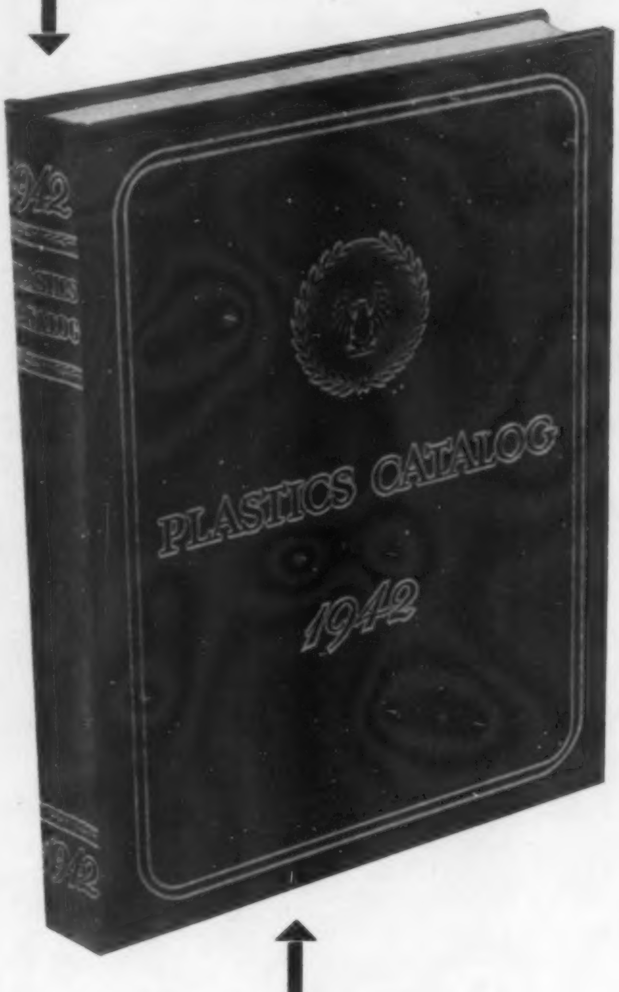

AN EXTRA-LARGE printing of the 1942 Plastics Catalog has insured a few copies on hand to take care of late purchasers. The advance sale of the book, and the great interest aroused by its actual appearance, have cut into our reserve of sale copies, but some orders can still be filled.

The reasons for the greatly enlarged purchase of the book are obvious: it is the only up-to-date and complete source of information about all plastic materials, all methods of manufacture, all equipment; it contains the only complete and up-to-date Directory of the plastics manufacturing industry and of all suppliers to the industry. The 1942 edition, encompasses an exciting new section on "Plastics in Defense" which gives details and photographs of actual uses of plastics in the Army, Navy, Marine Corps, Air Corps and other arms and branches of the Government. All the highly useful charts of Plastics Properties, Properties and Uses of Solvents and Plasticizers have been expanded to include the newest materials and the latest knowledge about them.

Many color plates show the various plastic materials in their full glory. There is a separate article about each basic material, about each method of manufacture including all types of molding and casting, extruding, mold-making, finishing operations, machining cast resins, synthetic rubbers and fibers, flow sheets, etc. The Directory of molders, extruders, laminators, etc., and suppliers to the industry is alone worth the price of the book which is

$5 per copy ($6 for Canadian and Foreign)

SIZE: 9" x 12" • PAGES: 634 • CASE-BOUND

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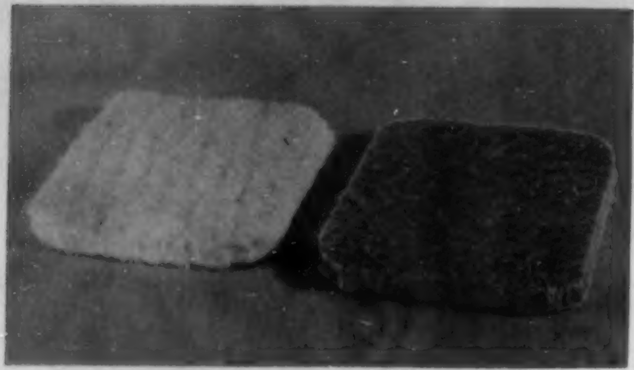
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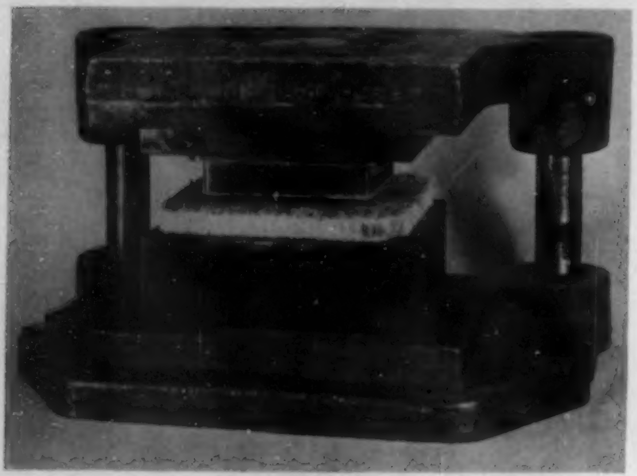
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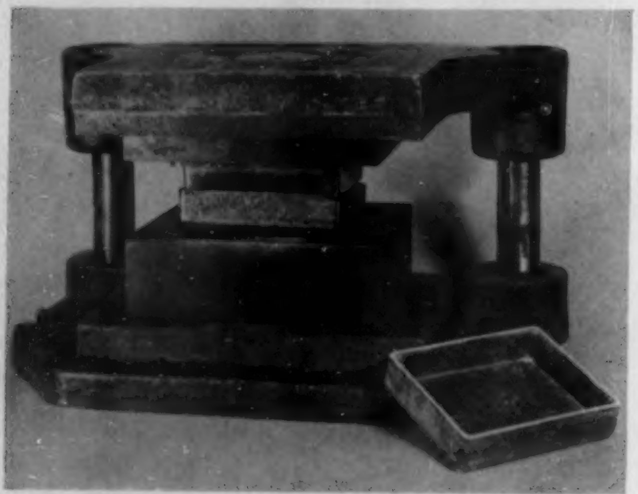
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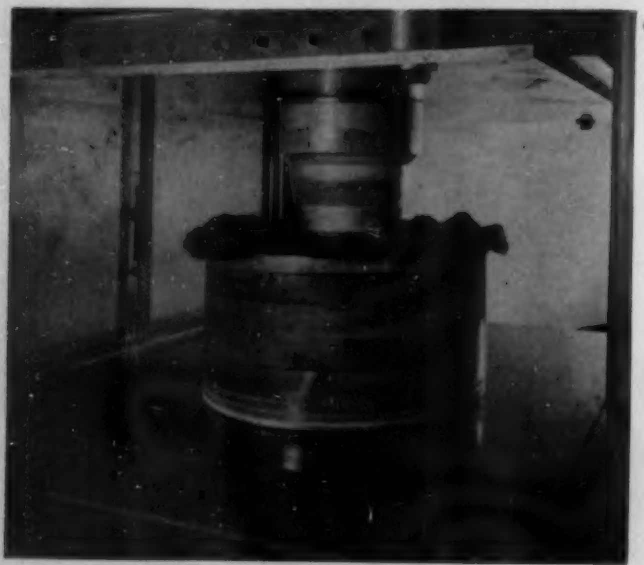
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Molding phenolic-sisal

(*Continued from page 53*)

Applying the methods thus far described would not take care of thin-walled moldings such as cigaret boxes or helmets. Methods have been developed for molding thin-walled, deep-drawn pieces of this type. The photographs and sketches (Figs. 3, 4, 5) showing the steps in molding a three-quarter inch deep, rectangular box illustrate the fact that the phenolic sisal material can be drawn from the flat sheet providing it is cut to the proper shape. The depth to which it can be drawn for a given size cavity opening is limited, however. The slope of the side walls of the cavity is also a factor affecting drawing.

Consequently, two methods have been devised for making preshapes. The preshapes are generally made in the contour of the finished article and require no drawing, but only curing and pressing in the mold. The first method consists of cutting the molding material to a definite pattern and folding or bending it into the shape which best adapts itself to the contours of the mold. Seams, which seal during curing, are staggered so as not to coincide if it is desirable or necessary to laminate the preshapes. Stronger joints are secured by laminating two identical lightweight preshapes in this manner than could be devised by curing one preshape of material twice as heavy.

Where uniformity of impact resistance is sought, seams are undesirable. Accordingly a method was designed for making seamless preshapes. The unimpregnated fiber batting is drawn into shape in inexpensively constructed molds in a manner similar to that by which metal is drawn. As in the first method, the general outline and contour of the preshape is the same as that of the finished article. After drawing, the fiber is impregnated either with liquid resin solution or with powdered resin solids. Figure 6 shows the sisal batting being drawn into the shape of a helmet. Preshapes are shipped ready to mold if the necessary data to construct a mold of the proper shape are supplied.

An interesting application of phenolic sisal material is its use in combination with other molding compounds. When high strength, irregularly shaped articles with a very fine finish are desired, the sisal sheet can be employed as the skeletal structure. The mold is charged with uncured phenolic sisal sheet and surfacing compound, and curing is effected in one operation. In spite of the fact that long, closely intermeshed fibers make up a large part of the weight and volume, it is also possible to mold the phenolic sisal material into irregularly shaped pieces by transfer molding methods.

It is inevitable that problems which are not covered herein will arise as other applications for this new molding material are explored. The possibilities and limitations of phenolic sisal molding material will be further defined in the course of research work on these special problems.

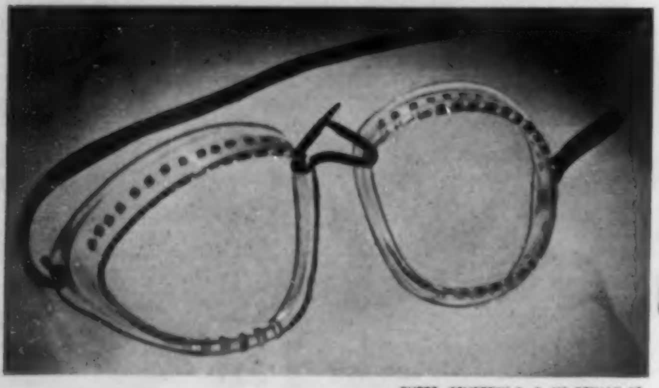
Credits—Material: Co-Ro-Lite and Co-Ro-Felt, Columbian Rope Company; Durez phenolic resin.

3—*Sisal batting (left) impregnated with phenolic resin (right) to form precut phenolic-sisal sheet ready for molding into small box.* **4**—*Mold and phenolic-sisal assembled. Mold ready to close.* **5**—*Finished box with the flash removed.* **6**—*Sisal fibers in process of being drawn into the form of a helmet. The preshaping mold is partially closed. Note pressure ring for holding material*

Protection for production

(*Continued from page 45*) trived by impregnating heavy cloth or light canvas with a phenolic resin and molding several layers of the plastic-treated material to the desired shape. Some of these helmets have a wire mesh interlayer for added strength. This type of molded-laminated plastic helmet is popular with construction workers, sandhogs, miners and others who need to be protected against falling objects because it fits well, weighs little and is comfortable to wear. The U. S. Army Quartermaster Corps has developed for military use a helmet with a plastic liner. In this two-in-one type of headgear for the modern soldier, the outer helmet of steel fits closely over the inner section, which is composed of fiber impregnated with a synthetic resin bonding agent, pressed to shape under heat and coated on both sides with a light fabric.

When welding is done by hand, the cellulose acetate machine guard described on page 44 is replaced by a hand mask and face mask worn by the operator. These masks may be made by the same phenolic resin impregnation process used in making the helmet, employing fiber or heavy paper for the basic material. The view medium for the face mask worn by welders is transparent cellulose acetate in dark colors.



PHOTO, COURTESY B. O. MC DONALD CO.

Transparent plastic eyeguard with lenses and frame molded in one piece provide clear vision, protect eyes against flying objects

Protective goggles, among the first safety devices adopted by industry in general, at first carried lenses made of glass, and consequently could not entirely safeguard the wearer's eyes against flying material. Methacrylate, cellulose acetate or polystyrene lenses now in use give greater protection without sacrifice of clarity of vision. Polystyrene in molded form has excellent optical properties; is unaffected by extreme cold and will not distort below 170 deg. F.; can be kept under water for 24 consecutive hours without absorption; and will not shatter. Its use is most feasible where mass production justifies the mold cost. For lenses in smaller quantities, the easily formed cellulose acetate is more economical. Where high optical standards are required, safety glass lenses laminated with vinyl or cellulose acetate plastics are used.

Some types of work call for a face-protecting shield that will not obstruct vision and be sufficiently light in weight to cause the wearer the minimum of fatigue. A lightweight cellulose acetate of .020-in. to .003-in. gage will meet these conditions, giving the wearer relief from wind, small particles of material and medium heat. Non-industrial uses of plastic face shields are also increasing, as such outdoor enthusiasts as mountain climbers, skiers and ice skaters come to appreciate their protection against icy wind and stinging snow and their quality of unbreakability in case of falls.

Lighting applications

For the past two years, the public has been introduced on a large scale to fluorescent lighting, a cold type which requires less electricity to operate. Cellulose acetate material used to shield the lighted tubes contributes to a soft, unbroken, shadowless light which closely resembles daylight. Control of light diffusion and transmission is obtained by the design embossed on the surface of the plastic sheet. The most important function of the diffusion panel is to cut down the brightness of the bulbs and produce glareless illumination. With wartime production on a 24-hour basis, thousands of men and women not accustomed to working by artificial light are now on night shifts. Continued eyestrain reduces a worker's productive capacity as surely as does an injury to his eyes; and because a plastic-shielded fluorescent light is the closest approximation of sunlight yet devised, its widespread adoption in plant and office is to be anticipated. For use with standard fluorescent lamps designed for critical inspection and assembly work, another type of shield has parallel black louvers or slats running through the plastic which deflect the lamp's rays, thus eliminating glare and permitting accurate scrutiny of the items under inspection.

As U. S. production increases, safety engineers will have many new problems to solve. It is to be expected that they will develop additional uses for plastic materials in their search for better ways of protecting the lives and limbs of American workers, upon whose shoulders rests so much of the responsibility for the successful prosecution of the war.

X-ray diagnosis

(*Continued from page 47*) method by which an observer watches the cartons on the belt. Any suspicious carton can be ejected by means of a foot treadle, dropping down the chute visible in the right foreground of Fig. 4. The operator shown in Fig. 4 then opens the carton and fluoroscopes individual pieces until the defective one is discovered.

This method of conveyor belt examination is particularly useful for molded products. Small bubbles, improper alignment of inserts, or other deviations from normal can be detected by a trained observer without delaying movement of the product along the assembly line. The x-ray equipment can be arranged to fit almost any system.

Figure 5 shows an x-ray study of fountain pens, made to determine the accuracy with which metal parts were imbedded in the plastic. Similar studies are made whenever metal is molded into plastics, especially when the mechanical strength of the union must be beyond question. If the metal inserts must be accurately aligned to fit into other parts, x-ray examination will provide a positive answer.

In all such cases, destruction of the finished part is avoided. Each piece may be examined and passed if satisfactory, or rejected if defective. It is unnecessary to rely on occasional "spot" testing by cross sectioning the sample piece. Production-line examination is strongly recommended whenever failure of a part might produce results out of all proportion to the small item involved. Airplane parts are routinely checked for this reason.

Its trial period ended, the use of x-ray in industry is gathering momentum. A few applications require the use of radium or supervoltage equipment, but the vast majority of work is done with apparatus of moderate size, extremely flexible, easy to use.

PHOTO, COURTESY PLASKON CO.

4—Non-shattering corrosion-proof lightweight lampshades of molded urea used on battleships

Spreading the light

(***Continued from page 51***) distribution achieved with a minimum of shadows. One-third lighter than glass, they add little weight to lamps which are usually top-heavy, and are easier to handle and install.

Government-sponsored FWA housing projects, schools, hospitals and barracks for the country's armed forces are among the new construction jobs in which plastics for lighting have been used. An adapter-type reflector on a molded central ceiling fixture is one kind of combination unit used in living rooms and bedrooms. Various wall fixtures and bowl reflectors for ceiling units and portable lamps are found in other rooms (Figs. 2–3, page 51).

Typical is this comment of Oscar Stonorov of Hettel & Stonorov, architects in charge of the Camden, N. J., Defense Housing program to provide modern, comfortable homes for that city's vastly expanded population of industrial workers. He states, "The architects wanted to make a definite departure from obsolete lighting standards for low cost housing, and they were particularly insistent upon properly shaded bulbs. Plastic shades were chosen because of cost, reduction of breakage, and because of luminous and reflecting qualities of the reflectors. . ."

Factories and offices have also adopted plastic lighting. A. R. Clas, architect for the Federal Loan Agency Building and the new Maritime Commission Building, both in Washington, D. C., reports, "It was our desire to secure indirect illumination of the highest efficiency and still retain a luminous bowl fixture. The plastic bowl resulted in low cost, elimination of breakage, easy cleaning and high reflection. They have proved very satisfactory, and, as you know, have been specified for the building for the United States Maritime Commission, which is now nearing completion" (Fig. 1).

While molded urea reflectors are playing an important rôle on the home lighting front, their advantages have not gone unnoticed by military and naval architects. Molded fixtures and reflectors have been installed in camps throughout the country, in hospitals and in various types of military and industrial training schools. On the vessels of the new U. S. Merchant Marine fleet now being built under the direction of the U. S. Maritime Commission, molded urea safety reflectors provide adequate lighting below deck, are considerably lighter than glass and decidedly less fragile. Durable, washable, these plastic units withstand the corrosive action of salt air and fill the need for efficient lighting at low cost. Also used on battleships (Fig. 4) they resist the shock and concussion caused by the firing of the roaring 16-in guns.

Credits—Material: Beetle. Molder: Waterbury Button Co. Corona reflectors designed by Kurt Versen, Inc. Molded by Bryant Electric Co. Plaskon battleship lampshades molded by Plastics Dept., General Electric Co. for Lovell-Dressel Co. Also molded by Plastics Div., Owens-Illinois Glass Company.

Process anneals—mold steels

(*Continued from page 63*) From the above we conclude:

1. Process anneals can as well be used for alloy as for iron and these need not be much beyond 1200 deg. F. The relatively low temperature process anneals, because they are subcritical, may be carried out without the need for slow cooling from the annealing temperature. At the same time the difficulties of protecting the surface are measurably less.
2. The alloy has considerably higher compressive strength, in the treated die, than iron and so is less prone to swamping of the surface of the die in extra heavy service.
3. The lower critical temperature of the alloy die steel permits a complete reorientation of the grain, after hobbing, at lower furnace temperatures than the plain carbon steel.
4. While nickel itself does not assist carburizing, it does permit this operation to be carried on at temperatures which are below the upper critical of the simpler steel.
5. Fatigue properties of nickel alloy hobbing die were not investigated. It is recognized that nickel enhances fatigue resistance, which property is, doubtless, of importance in long run dies subjected to severe intermittent compressive strains.

Mineralite—a filler

(*Continued from page 66*)

Cold molding compounds

	Percent
Gilsonite	7.6
Boiled linseed oil	7.6
Stearin pitch	4.8
Asbestos floats	40.0
Mineralite	40.0

To facilitate mixing, 5.5 percent of solvent naphtha and 2 percent of mineral oil were added. This composition made excellent cold moldings. The flow was good and the surface satisfactory. The baked articles were hard and strong.

Another formula tried consisted of:

	Percent
Gilsonite	3.8
Boiled linseed oil	3.8
Stearin pitch	2.4
Mineralite	90.0

Still another was as follows:

	Percent
Orange shellac	15
Lump rosin	12
Gum copal	17
Cotton flocks	5
Mineralite 3-X	44
Carbon black	7

Mixing solvents, 5.5 percent of solvent naphtha and 2 percent of mineral oil, were used. This formula had a good flow and the surface was hard and very satisfactory for cold molded articles.

Up to 75 percent of mineralite has been added to the phenol-aldehyde casting resins with excellent results. No detrimental effects were found on the chemical or heat acceleration of the cure.

TIME IS SHORT

Passing the bottle

(***Continued from page 42***) and grinding action of glass fragments from bottles—which occasionally are broken on *every* bottling machine. In fact, the material used on the dials and guides must be hard or tough enough to actually *break* bottles so that in case of a jam during operation, the bottles rather than the machine parts will be destroyed. This prescription, of course, is a precautionary measure.

The point where the bottles first enter the propelling dials is the most fatal. It is at this point that the Crown Cork and Seal Co. applies laminated plastics to every model of its entire line of bottling machines. On its highest capacity machine, the entire set of bottle handling equipment is edged with this material. Fig. 2 shows the bottle table of one of these machines in which all dark areas around the propelling wheels and guides illustrate laminated plastic edgings.

The edgings are rough cut from cotton fabric-base laminated phenolic sheets, measuring 39 in. by 47 in. and $^5/_8$ in. in thickness. They are then profiled to exact size. This stable material is particularly suitable for the rotating machinery surfaces as high impact and mechanical strength are required. It has a durable semi-gloss finish, good resistance to moisture, acids, alkalies, solvents and the various liquids employed in bottling procedures. Its resiliency not only breaks the shock to bottles, reducing the noise made by their movement, but also reduces vibrations which cause wear on the machinery.

Laminates have been found by bottlers to be tough and lasting, yet easy on the bottles. They are a sort of "soft" hard material, just about right for application to the dials and guides. Their physical properties make laminates easy to work. They can be sawed, drilled or profiled with ordinary small woodworking tools. And aside from their usefulness in protecting bottles, they are easy to attach to the bottle handling equipment frames and are a good looking polished trim for the bottling machine itself.

Credits—Material: Phenolite, National Vulcanized Fibre Company.

Cellulose acetate wire yarn

(***Continued from page 50***) substantial cost saving, and by the advantage to be obtained by having an assured source of supply within this country.

About twenty years ago a preliminary investigation was made on samples of imported cellulose acetate yarn, which indicated that its electrical properties were superior to those of silk. It was, however, a new material with no assured source of supply and no experience was available as to its aging properties. At that time it was only a promising possibility for future use.

By 1925 the trend toward the use of acetate yarn in the textile industry was accompanied by the establishment of several plants in this country to produce this yarn. With assured sources of supply available, trial installations of the wire using acetate yarn were made in several telephone central offices. These installations, were made primarily to determine the handling characteristics of the material during manufacture and installation, and to obtain data on the aging properties under service conditions. At that time, mechanical difficulties experienced in handling the wire offset the price differential between the silk and the acetate yarn so that no economic advantage could be obtained by its adoption. (*Please turn to page 100*)

NORTON ABRASIVES

WE CROSSED A BUTTERFLY WITH A DARNING NEEDLE

For Better Airplanes

Look at the photograph. Tiny pieces of just the right Metalite Cloth back to back, poked through the eye of a common darning needle. Fitted to one of your own portable tools it removes burrs from oil holes too small to finish in any other way. At the same time it puts a perfect radius on the sharp edges. Seconds in place of minutes!

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With further expansion in the use of acetate yarn in the textile industry and the resulting reduction in price, it appeared desirable in 1938 to make further studies of the possibility of introducing the change. In the meantime, the methods of handling the acetate yarn had been developed so that it could be used in the regular manufacturing processes without difficulty. Tests made on yarns manufactured at that time confirmed the results of previous tests regarding the superior electrical characteristics of this material as compared to silk; and tests on cables removed from the trial installations after fourteen years of service showed the aging aproperties to be satisfactory. About that time the importtions of the spun tussah silk were diminishing rapidly. Consequently, the spun tussah silk was replaced by acetate yarn in all switchboard wire, switchboard cable wire and distributing-frame wire.

The advantages to be gained by the use of the acetate yarn from the standpoint of electrical characteristics and price not only warranted the substitution of this material for silk in the silk- and cotton-insulated wires, but amply justified the use of a wire with double wrappings of acetate yarn, a single wrapping of cotton and a lacquer coating in place of the wire which had heretofore been made with a double wrapping of cotton and cellulose acetate lacquer coating. This provided a single type of wire for both switchboard wire and switchboard cable which could be used without any distinction as regards type of service. By eliminating one type of wire it has reduced the number of colored wires to be manufactured and stocked by approximately three hundred. It also improved the electrical characteristics of both local and toll circuits. The annual production of these wires totals several billion feet.

Credits—Cellulose acetate lacquer by Western Electric Co. and cellulose acetate fiber by Celanese Corp. of America

The "Baltimore" mast

(*Continued from page 40*) preform consisting of five layers near the bottom of the base prior to final molding. This expedient increased the design value of the base so that instead of failure at some 65 percent of full load, the failure occurred at 120 percent of full load. This was considered satisfactory. Figure 5 shows the failure of the final test specimen at 120 percent design load. The fabric insert molded into the macerated base is clearly visible.

As a result of these and several other major types of tests, the mast illustrated in our November issue was developed. However, other changes were later necessitated by flutter characteristics developed during routine tests. The mast assembled in accordance with the original design had a natural vibration frequency which was considered ideal for installation on the "Baltimore."

When the antenna was rigged to the mast, the heavy strain insulators that formed part of the antenna rigging were attached close to the tip. This added load, in combination with their position, had the adverse effect of increasing the natural frequency of the mast alone 50 percent when it was tested under this load. The increased loading resulted in excess vibration with approximately 3 in. amplitude at the tip.

After a few test flights it was determined that a decrease in length of 9 in. would make the frequency vibration of the installation fit the desired range.

The shortening of the mast involved a revision in the de-

sign of the mast cap. In the original design the cap was coated with cement pressed into the end and locked with drive screws. In the shorter model, the cap is molded to the mast in one operation, thereby eliminating one part of the original three-piece assembly (see Fig. 4).

Esthetically and functionally, this molded-macerated, molded-laminated mast has met the stringent requirements of aircraft engineering and design departments. Its shape complements the finely streamlined fuselage of this high-winged bomber, and its savings in weight can be translated into greater fuel capacity, with attendant advantages of range and bomb carrying power.

Dispatches from London repeatedly report that RAF pilots have high praise for the speed range, maneuverability and striking power of the warplanes built in this country for Great Britain under the Lend-Lease Act. The earlier success on the warfronts of these U. S. built bombers should be repeated in the achievements of their American Army and Navy counterparts, as the facts forged in the crucible of war are being applied to design and production of our own aircraft, and to the new models we must construct for our Allies.

Credits—Materials: Mast, Dilecto; base, Celoron, both by Continental-Diamond Fibre Company.

The little boats

(*Continued from page 37*) dart away before it can be fired upon. Speed and maneuverability are its defensive weapons as well as its striking strength.

These New Orleans-built motor torpedo boats now fly the flags of the British and the Netherlands Governments as well as our own, and their record of performance (which cannot, for obvious reasons, be given) has been excellent. The company builds for the U. S. Navy the 76-ft. boat shown on page 36, designated the PT-70. It has at present an order for 24 torpedo boats which will be 78 feet in length; and has constructed PT-5's and PT-6's, both 82-footers.

Landing boats and ramp vehicle carriers up to 36 feet in length built by the Higgins people make the same use of resin-bonded plywood in their construction as do the torpedo boats. The light weight of the motor-driven landing boat enables it to disembark close to the shore an expeditionary landing party of 39 men, two machine gunners, a coxswain and an engineer. Because it draws approximately 3 ft. of water, it can pass over coastal mines which are set off by any vessel drawing more than 10 feet. The spoon bow construction entraps the aerated water under the forefoot, reducing skin friction, increasing speed, and enabling the boat to turn fast enough to meet head-on the next following sea. By means of a vee midship section and a reverse curve aft, the boat dispenses this aerated water out the quarter, thus avoiding cavitation—or the propeller turning in aerated water—which would reduce its speed. This is the type of boat used also by the Commandos—the small bands of specially trained men who, in the disguises that have earned them the name of "Black Phantoms," raid enemy territory at the dark of the moon to spy out the land, destroy property, snatch prisoners and terrify the natives.

The bonded plywood vehicle carrier, like the landing boat, can be run up on the beach to disgorge a jeep, a reconnaissance car or light mechanized equipment such as a 75-mm. field gun and its tractor, known as a Marine Corps Prime Mover.

The Higgins company expects to increase its use of resin-bonded plywood for all types of boats. It has already constructed commercial boats up to 100 feet in length which in-

corporate large amounts of this material. In its new shipyard on the Industrial Canal, it hopes to turn out cargo vessels up to 300 feet long made entirely of plastic-bonded plywood. Designs for these boats are now being worked on, and necessarily require extensive research, since plastic materials have never before been employed for principal structural members of boats so large as these. The unavailability of structural steel and the unwillingness to return to the wasteful methods of massive timber construction prompt the firm to enter this new field. Manufacture of plastics from sugar cane and the fabrication of such plastics into structural members that might be used in ship construction is also being investigated.

Much of the plastics research work done by the company has been in cooperation with the Navy and the U. S. Maritime Commission. To a recent conference in New Orleans came manufacturers of plastics, glues and plywood, together with leading authorities in the plastics field, for consultation on the practical possibilities of naval construction contemplated by the company. The Delgado Trade School of New Orleans, which for years has trained workers for the Higgins plant, now includes a course in plastics in its curriculum; and the company has established a fund to be used for plastics research work at the school. Naturally, the nature of research work being done, or details of contemplated design and construction of larger bonded plywood boats cannot be given.

The importance attached by the Government to the place of the little boats in universal war is suggested by the fact that Higgins Industries has for several months been conducting a series of two-week courses in its Boat Operators and Marine Engineers Maintenance School for enlisted men and officers of the Army, Navy and Coast Guard. The men are taught how to land boats and their equipment on different types of beaches in varying weather conditions, and how to operate and care for gasoline and diesel marine engines.

This is not a war like other wars. The Maginot Lines, the Singapores—even the great capital ships—have failed to live up to what was expected of them. Men are revising their ideas of warfare, forced by the ponderous weight of facts to reject much on which they had depended, and to accept much that they would have regarded as absurd a few brief years ago. Certainly few had anticipated a war in which attacks upon a powerful and well-equipped enemy would be made successfully by little groups of men in little plastic-plywood boats!

Credits—Material: Haskelite, by Haskelite Mfg. Corp. for Higgins Industries, Incorporated

Heavy section injection

(*Continued from page 65*) cycle. Other 8-oz. shots in thin sections may be made in shorter cycles.

To avoid shrinkage on heavy section shots, the plunger is often left in longer than is customary in conventional molding practice. Where difficulty is encountered in maintaining specifications, shrinkage may also be more closely controlled by leaving the mold closed longer, after the plunger returns, than is usually done in molding lighter sections.

Mold and gate design

In many cases where difficulty in molding is encountered, the attempt is made to trace the trouble to the machine or heater, while in reality mold construction is the cause of the poor results. It is possible to outline only a few of the more frequent factors in mold design affecting heavy section molding here.

1. Most important, sprue hole and nozzle should be large

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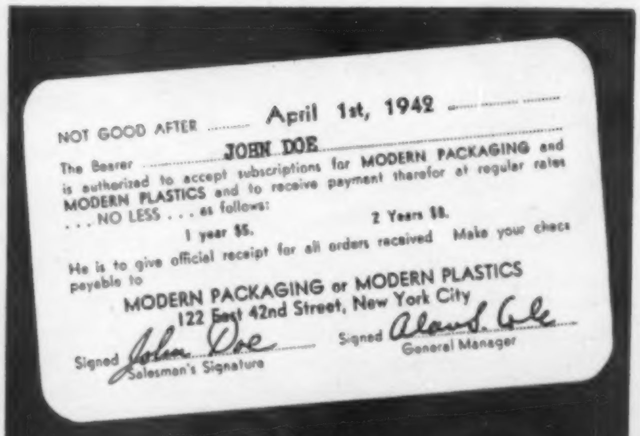
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enough to allow regulation of mold filling by changes in the plunger pressure and/or timer setting. Too small a nozzle prevents quick flow of material and builds an excessive back pressure in the heater. Too small nozzles also cause entrapping of gases due to fold-backs, with consequent welds. But most important is the fact that too small nozzles also appear to cause a sluggish or unpredictable response to regulative changes in temperature and pressure. When the attempt is made to fill a heavy section from a small nozzle, the actual injection cycle is too long, causing differential cooling in the molded piece with resultant strains between the first and subsequent parts of the material stream. This is clearly revealed by examination with polarized light. Current trade practice, therefore, seems to favor larger nozzle openings and sprues, especially in heavy section molding.

In making injection molded pieces for industrial applications, it is often advisable to make a clear piece and examine it under polarized light. This will give the key to location of strains caused by improper filling flow, incorrect gating and weak welds. It will enable the designer to suggest better methods of gating cavities to control filling waves, and give the molder an idea of proper speed of injection.

Polarized light is not now widely used in the plastics industry but it will become more important. Imperfect welds where a dual gate is used can be detected with polarized light. It will also indicate the need for annealing of plastic pieces designed for industrial applications where uniform strength is required. Very few molders are aware of the strain caused by molding and, as industrial requirements become more exacting, examination of injection molded pieces under polarized light and annealing will be more important.

2. In general, rounding of material passage corners is recommended. This enables one to increase the sprue size at the point of contact with the leader, and remove obstructions to the flow of material. Material contact with abrupt corners results in minor weld marks and weak welds. This is apparently because the corners are of varying cross section, and the portions first touched by the material lose temperature most rapidly when the mold is open. This momentary or relative chilling during injection, until all parts of the mold are equalized in temperature, results in many rejections for minor marks or flaws. The most successful molds appear to be those where material passages are oversize, especially in heavy section molding. There seem to be few set rules for designing material passages. It is mainly evident that there is no distinct increment ratio for calculating the area of the leader sprue or gate to feed any given cavities. One can only observe that the greatest measure of success seems to attend the mold maker who leans toward generous leaders, large sprues and gates. Few mold makers have facilities for testing performance of molds. Frequently extreme machine adjustments are made in the endeavor to use a mold which is not adapted to current production requirements. This often materially impairs machine life.

3. In current large-section molding practice, gates are being made as large as practicable with the particular product. This sometimes prevents marking, and makes the control of the actual molding process more responsive to changes in temperature and pressure as required by the operator. In addition, since large gates, sprues and nozzle allow a freer flow of material, the cycle may often be shortened, since the time required for filling the mold is cut down. It should not be overlooked that there are molds where a longer filling cycle is beneficial, in which case plunger speed control or smaller nozzles, etc., may be used. (*Please turn to page 108*)

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The single objection to large gates is that trimming is necessary. Wet belt or wet disk sanders are used for polishing gated areas. Production time is shortened in spite of the added operation since the machine cycle is often shortened by enlarging gates; and rejects are cut down since filling is consistently accomplished without running material as hot as required to fill all cavities through tiny gates.

4. The venting of large section molds is very important to prevent air burns, and in some cases entrapped "gases." Often the cause of poor pieces is sought in the adjustment of temperature and pressure, when in reality the difficulty lies in insufficient venting. Venting of large molds is sometimes done by relieving the faces one or two thousandths over a broad area, or else by providing vent gates. Sometimes the vent is located in the overshoot runner, and if any flashing occurs it is trimmed off later when this blind gate is removed.

5. One of the factors often overlooked in venting is to provide gathering channels or runners for escaping air that go clear to the edge of the die faces. The cavities and the flash surfaces may be vented but the vents themselves not run to the edge of the mold. With improved mold-making techniques, where the entire face of the mold is ground finished, this outside venting of vents is important.

There are summarized below several obvious suggestions concerning mold design which, nevertheless, are sometimes overlooked when laying out plastic injection molds.

Break large flat areas by ribs or designs. Also avoid shadow marks on flat decorative surfaces caused by opposing rib or trough by camouflaging the surface with ribs or designs. If possible fill the mold parallel to the ribs, not across them.

Terminate large projected surfaces in beads or ribs to eliminate trimming, to increase strength and to prevent warping in use.

Put fillets in all sharp corners, and round all possible sharp edges to avoid flashing and sticking in the mold. Fillets increase the strength of a piece and prevent formation of points of weakness where a crack may begin.

Adequate draft allowance should be made to prevent sticking in the mold, or deformation of the piece during removal manually or by ejector pins.

Self tapping screws instead of tapped holes are recommended where possible.

Heavy pieces should be located as near the center of balance as possible. Offside shots result in excessive strain on the machine, especially if flashing occurs.

Modern plastic molds for injection molding machines are being made smaller and lighter as it becomes increasingly apparent that new mold-making techniques are required for this process. The influence of the old massive compression mold lingers on, nevertheless.

Miscellaneous recommended practices

1. Dusting with zinc stearate or any of the special powders available is often resorted to in molding heavy sections. It is noted, however, that in many instances dusting powder is never used at all. In these cases, foremen have felt that sticking and marking was due to incorrect mold design and knockout pin location, or to improper temperature and pressure settings for the particular job. When deformative sticking is encountered, therefore, it is in these areas that correction is probably best sought, rather than in excessive adjustments of the molding machine at the outset.

Mineral oil and glycerin are sometimes used on a dry, clean rag to lubricate molds. Use of these materials eliminates the

loss of a piece following application of the lubricant as often happens when zinc stearate is used. Mineral oil and glycerin are often helpful in lubricating molds used for making clear pieces.

2. In many cases, heavy sections are immersed or quenched in cool or warm water to prevent sagging of surface areas or bubble formation. Sometimes it is found necessary to maintain quenching water at a desired temperature. In this instance a thermocouple lead from an indicating pyrometer is inserted in the quenching basin. Cold water is added only as required to maintain the necessary temperature. An overflow is provided, and heat from the material keeps the water at an even temperature. A water pan is sometimes made to fit between the housings, and the molded pieces allowed to fall directly into the quenching water. If the freshly molded piece is soaked too long, some materials tend to show a flaking or develop a clouded or dusted appearance on the surface after several weeks storage. Quenching or immersion to help maintain specifications, however, is recommneded as a general rule in heavy section molding, especially if it can be done under controlled conditions.

If the practice of dipping is used, particularly before removal of runners and spruces, these scrap parts should be carefully dried and ground before re-use. In general, even if runners and gates are not dipped, best heater performance results when they are ground before re-use.

If the molded piece cools too rapidly, or if the mold surface has not been maintained at the proper temperature, differential cooling takes place, causing the formation of seeds or bubbles. The surface of the piece may set so hard that, when the interior or still soft material cools, the resultant shrinkage appears to cause a surface sagging and/or vacuum bubbles in the piece. In some cases, overheating of material prior to injection appears to cause gas bubbles or seeds, or burnt spots, probably resulting from decomposition or "burning" of material. In other cases bubbles are formed by moisture in the molding powder. In a few instances, die design causes them. Often a persistent bubble can never be completely removed from a given piece, because of trapping of gases due to incorrect material flow, or failure to judge correct nozzle size to match the requirements of the mold openings.

3. In rare instances a vacuum attachment has been successfully used to aid in making heavy pieces. This is not recommended as a general rule, since the practical mechanical results of current commercial vacuum application to plastic dies are not predictable. Adequate venting in most cases has given results commensurate with those achieved by relatively expensive vacuum attachments and accompanying extensive mold alterations.

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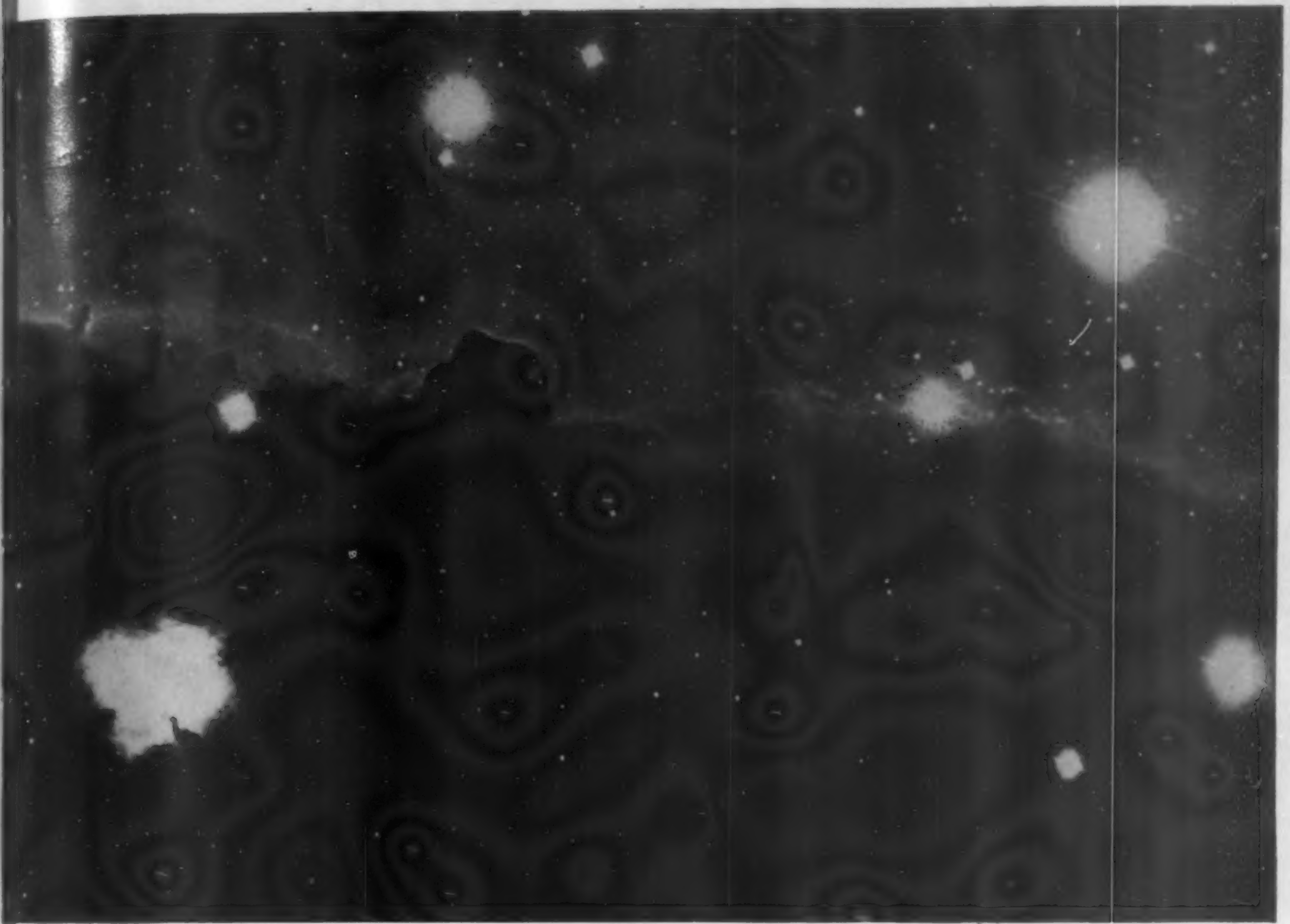

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